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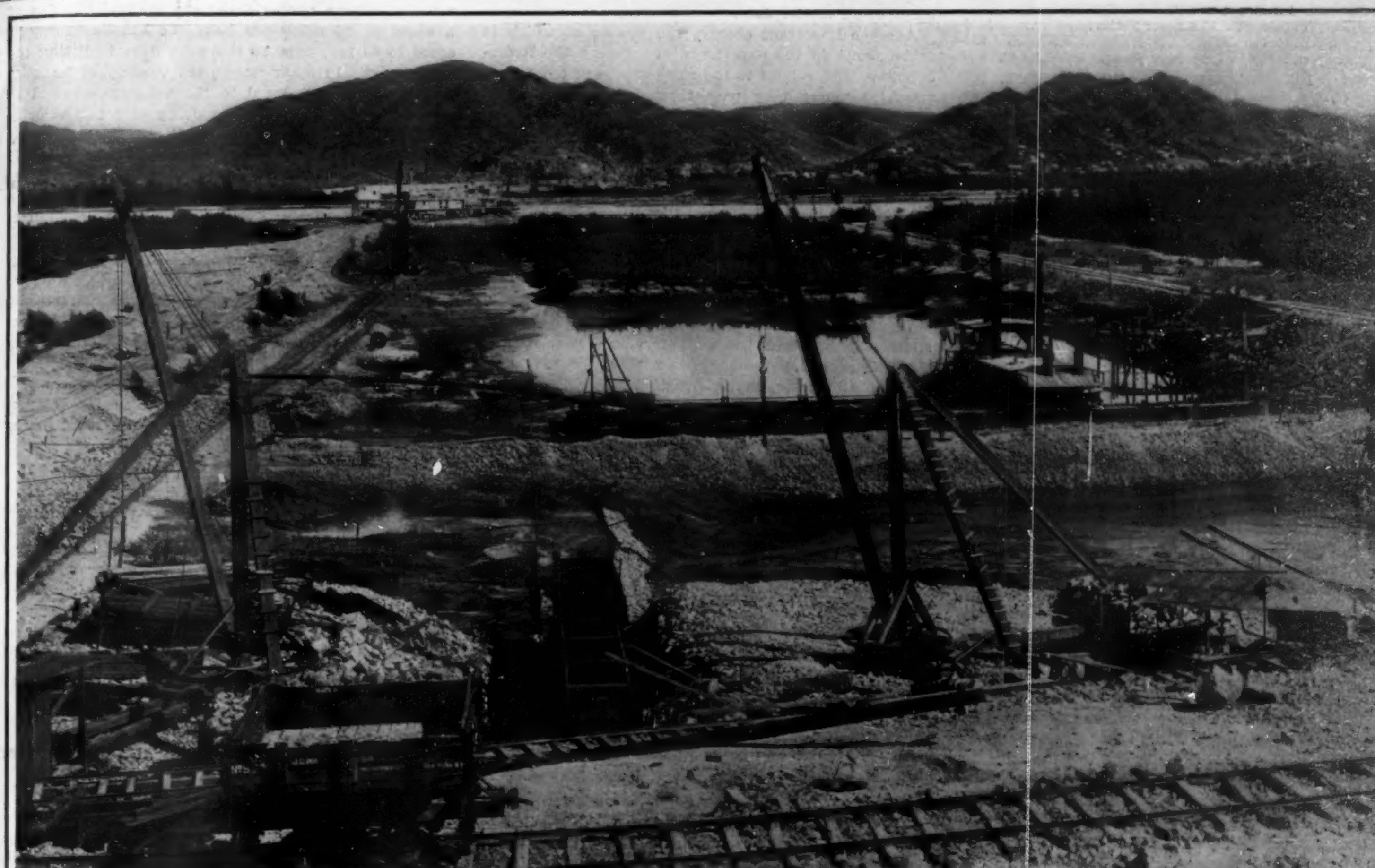

Filling in the adjacent lowlands at dam. Note tree growth to break force of current.

View below the dam, showing the river in flood.

THE YUMA IRRIGATION DAM.—[See page 302.]

SCIENTIFIC AMERICAN

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NEW YORK, SATURDAY, OCTOBER 31, 1908.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THAT NEWPORT CONFERENCE.

Some few months ago a conference of leading officers and officials of the navy was held at Newport behind closed doors. Although the only fact positively made known to the public regarding this assembly was that its deliberations were to be held in absolute secrecy, the close of the conference was followed by the usual and seemingly inevitable leakage of information. The latest statement of what occurred appears in one of the current magazines in the form of an anonymous article. The facts there presented agree fairly well with the whisperings which have gone abroad regarding the doings of the conference; and they may be taken, we doubt not, as fairly correct.

The Newport conference, it has been pretty generally made known, was called by the President for the consideration of the alleged defects in our warships; and we are told that the whole of the charges made in a certain magazine article and reiterated in the subsequent controversy were carefully gone into. The members of the conference represented every branch of the service that has to do with the design, construction, and subsequent handling of our warships and their equipments. Members called to the conference brought with them elaborate statistics, drawings, etc., bearing upon the disputed points, and the opposing parties were given an opportunity to state their views, compare notes, examine into the supposed defects, and propose the proper remedies.

It will be remembered by those who followed the controversy in its early stages that the principal charge made against our battleships was that their armor belts were altogether too low, and that it was urged that in future ships these belts should be raised several feet. It will also be remembered that, in an investigation of the facts, as given in the Scientific American of January 25 of this year, it was shown that the armor belts of our ships are placed in the same relation to the normal water-line as those on the battleships of leading foreign navies. It was further shown that to raise these belts several feet, as the critics desired, would be to bring the unarmored under-water portion of the hull nearer the surface, and put the ships in that much greater peril, when they were rolling at sea, of being pierced in their vital parts and either sunk or permanently disabled.

It now appears, according to figures given by the anonymous writer of the article above referred to, that it was finally determined, not that the water-line belts were too low, but that they were not low enough; for in future warships the top edge is to be 4 inches higher and the bottom edge 12 inches lower, measured with regard to the water-line of the ships when they have two-thirds of their coal, stores, and ammunition aboard. In other words, the whole body of the armor belt is to be sunk in new ships 8 inches lower with regard to the normal water-line than it was the custom to place it before this Newport conference was held. For it must be remembered that the normal water-line under which our existing ships were constructed is the water-line (to quote the official designation) of the "ship as designed, fully equipped, ready for sea, with two-thirds of the coal supply, ammunition, and stores."

So much for the armor belt controversy.

The conference further voted that the broadside guns for defense against torpedo attack shall, in the future, be mounted one deck higher than in the present ships; that is, they will be moved up from the gun deck to the main deck. This decision was based upon the experience of the fleet under Admiral Evans in its cruise to the Pacific, when it was found that the guns on the weather side of the ships, when they were steaming at speeds of over 10 knots, were so wet as to interfere with the gunners. It should be clearly understood that this change was not recommended because these batteries were carried at a lower elevation than similar guns in foreign navies (as a matter of fact these guns are higher in our ships than in the British, German, and Japanese navies), but because it was realized that the greater displacement and wider margin of stability of our ships of the "Dreadnought" type rendered it possible to carry these guns at a higher elevation than could be done on the smaller ships of an earlier date.

Another important change, the motive of which is to be found in the experience had during the Russo-Japanese war, relates to the smokestacks of our future warships where they pass through the central box battery. In future this portion of the stacks is to be protected by armor. The Russians suffered great inconvenience from the penetration of the base of the smokestacks by shell fire, the furnace gases escaping into the battery and, in some cases, even into the turrets, and driving the men from the guns. It will, of course, be impossible to put armor of any great thickness around the smokestacks, nor will it be necessary. The shells that enter the broadside battery will be exploded by the 6-inch armor with which it is protected. It will be their fragments only that will strike the armored bases of the smokestacks, and penetration will be unlikely.

Taken altogether, the information which has leaked out through the closed doors of the Newport conference indicates that the broad principles of construction upon which the modern ships of our navy have been built received the indorsement of a very strong majority of the officers present. Some details will be improved, but no sweeping changes will be ordered either by way of reconstruction of existing ships, or redesigning of those at present under construction.

THE FORCE INVOLVED IN AUTOMOBILE COLLISIONS.

Every one who has witnessed the result of a serious automobile or railway collision must have been astonished by the evidence of the development of forces by which strongly built vehicles of iron and steel were almost instantly transformed into shapeless heaps of splintered and twisted fragments. Not every collision is as destructive as this, but the possibility of such a result is always present where heavy vehicles are moving with great speed, and hence an analysis of the conditions which determine the magnitude and effects of the forces of destruction will be of interest.

An automobile or, for that matter, any very swiftly moving vehicle is, in effect, a projectile which differs in no essential respect from a shell discharged by a modern field piece. The kinetic energy which a projectile possesses in virtue of its mass and velocity is necessarily expended in destructive action when the flight of the projectile is suddenly arrested by an obstacle of any sort. The destructive effects are divided between the projectile and the obstacle in the inverse ratio of their respective powers to resist deformation. For example, a shot fired at a board fence perforates and splinters the wood without itself sustaining appreciable damage, but a lead bullet fired at a steel plate is flattened without indenting the steel. If the projectile and the obstacle are similar in material and strength of construction, both will be damaged. In automobiles and other vehicles the conditions are essentially the same as in the case of the projectile. If, for example, the brakes are applied to an automobile when it is running at full speed, the kinetic energy of the forward motion is gradually absorbed by the friction between the brakes and the wheels, and converted into heat, and the car is gradually brought to rest. Again, if the motor is stopped without applying the brakes, the energy of motion is gradually used up in overcoming the resistance of the air, the rolling resistance at the points of contact with the road, and the friction at the axle bearings. The car, therefore, comes to rest, after running a distance inversely proportional to the magnitude of these frictional and other resistances.

To continue the comparison with a projectile, let us suppose that the car, running at full speed, is steered against a light picket fence, and the motor is stopped. The car will shatter the fence and go through it almost unharmed and with little loss of speed, but if it encounters a succession of similar obstacles it will finally be brought to a stop. Nor would one solid board fence stop the automobile, though it would reduce its speed, but the car would probably dash itself to pieces against a rocky cliff or stout masonry wall, without materially affecting either of those obstacles. In short, the weaker of two colliding bodies sustains most of the damage caused by the collision.

The effect depends also on the distance run by the vehicle between the first moment of impact and its final stoppage. Other things being equal the intensity of the destructive forces is inversely proportional to this distance, and the disintegrating effect of these forces depends more on their absolute intensity than upon the length of time during which they act. Hence a sudden stoppage, as in the case of collision with a stone wall, develops forces which the strongest materials cannot withstand.

At the moment of impact against an obstacle the moving car possesses a certain kinetic energy which is equal to the product of the force required to bring it to rest multiplied by the distance through which that force acts. This kinetic energy is also equal to the mass of the car multiplied by half the square of its velocity. For a car weighing one ton and running at a speed of 30 miles per hour the kinetic energy is equal to 60 foot tons, or the work done in lifting the car 60 feet. In other words, the velocity of 30 miles per hour is about equal to the velocity acquired in falling 60 feet, and if a car moving with this velocity strikes an immovable obstacle it will fare as badly as it would in striking the ground after falling 60 feet. The force of the impact is proportional to the square of the velocity, and the sudden stoppage of a car going 60 miles an hour is equivalent to a fall of 240 feet.

Now let us examine the conditions existing immediately after the impact. An automobile is an assemblage of many parts, of various degrees of strength. The shock is transmitted from the point of impact through all the parts, producing in each a tendency to break at its weakest point.

The work done in pulling apart a steel bar one foot long and one inch square is equal to nearly 4½ foot tons, but an automobile weighing one ton and running 60 miles an hour possesses energy enough to sunder 25 such bars, or 50 steel bars of the same cross-section and half the length either successively or simultaneously. The same amount of energy would suffice to shear off 260 1-inch steel bolts or rivets 500 ¾-inch bolts, 2,500 oak pins one inch square or 25 oak beams 10 inches square. The energy of the car is one-fourth greater than that of the 12-pound shot which leaves the muzzle of a 3-inch gun with a velocity of 1,000 feet per second. Such a shot is crushed on striking an armor plate of hardened steel, although it is protected by a steel cap, and as a whole is stronger than any part of an automobile.

In a head-on collision between two cars of equal weight and speed the amount of kinetic energy destroyed is twice the amount involved in the impact of either car against a fixed obstacle, but the destructive action is divided equally between the two cars so that the effect on each is equivalent to the effect produced by running into a stone wall. In a collision between a heavy and a light car, the latter suffers more severely than the other.

THE 1908 VANDERBILT CUP RACE.

The fourth contest for the Vanderbilt Cup will be memorable because, for the first time, the famous trophy was won by an American in an American-built car. It occasions no surprise that the honor should fall to a Locomobile; for those who were present at the race of two years ago will remember that it was a machine of this make, driven by Tracy, that made the fastest lap of the race; and that the uniformly fast running of the car would have probably landed it in the first position, had not continual tire troubles developed. This year, fortunately, there was only one tire mishap, which happened on the final lap and caused the loss of not over one minute. The fact that it was necessary to use non-skid tires the same as in 1906, shows that there has been a decided improvement in American-made tires of this type.

The course, which is 23.45 miles in length, was laid out to include some twelve miles of the new Parkway, which has been finished with an excellent concrete surface. The grand stand is located at the center of this stretch of the course; and it was over this section that the fastest time was made. The race consisted of 11 rounds, making a total distance of 258.06 miles. Seventeen cars started. Eleven of these were American machines, while of the remaining half dozen, one (the Isotta) represented Italy, two (a Hotchkiss and a Renault) France, and three Mercedes cars Germany. Of the American cars, the two Locomobiles and two of the three Thomas machines were high-powered racers, while the remaining Thomas, the 6-cylinder Acme, and Chadwick cars, and the two Knox and Matheson machines were more moderate-powered stock chassis, as was also the Italian Isotta car. All the other foreign cars were high-powered machines. Robertson made the fastest lap of the race in the winning car in 20 minutes and 54 seconds, or at the rate of 67.32 miles an hour, and the race was won by 1 minute and 47 4/5 seconds in 4 hours 48 1/5 seconds, at an average speed of 64.28 miles an hour, the second place being taken by the 60 H.P. Isotta car. A gratifying feature of the race is the fact that it was run without any fatality, or even serious accident, either to drivers or spectators.

ENGINEERING.

We are not surprised to learn that the engineers of the special commission appointed to examine the new Blackwell's Island Bridge, over the East River, are reported to have found that the structure is not equal to carrying the full number of proposed tracks and roadways. It will probably be suggested that two of these tracks be omitted.

It is gratifying to learn that the rapid rate of construction of the Panama Canal continues. The grand total of excavation during the month of September was 3,158,886 cubic yards, all of which, except 69,035 cubic yards, was excavated from the canal prism. Of the grand total, 1,374,856 cubic yards was taken out by dredgers, and the remainder was dry excavation.

The good and bad qualities of a street paving block made of iron slag may be summarized as follows: It has a hard and durable surface, does not absorb moisture, and may be readily cleaned. The abrasion being but small, it makes very little dust or mud. When it is properly laid it presents a true surface, and consequently the traction is easy compared with that of some other types of paving. On the other hand, experience has shown that it wears to a slippery surface, making it hard on horses, and there is a tendency to flake off at the surface, in which case hollows are worn, and the street presents an unsightly appearance.

Among the facts of interest brought out at the International Road Congress in Paris is the extremely small per cent of public roads in the United States that have been improved and rebuilt on modern lines. Out of a total of 2,151,570 miles of public road only 7.14 per cent, or 153,662 miles, have thus been improved. Most of the papers were agreed that the ideal road of the future should have a hard, unyielding foundation, with a surface of suitable broken-stone ballast, treated with some preparation to prevent the stripping of the top dressing. There is a consensus of opinion that treatment with tar has proved the most efficacious in shedding water and in keeping down the dust.

Railway travelers will have noticed the curious and apparently complicated valve mechanism which is being adopted quite generally on recent locomotives in this country. It is what is known as the Walschaert gear, which has been used for several decades in Europe, but has only recently made its appearance in this country. Its adoption is due to the increasing size of our locomotives and the difficulties experienced with the Stephenson link motion from the heating of the eccentrics. In the Walschaert gear the place of the eccentrics is taken by a return crank on the outside of the crankshaft. The gear being placed exterior to the frames renders it readily accessible for inspection and oiling.

It will be remembered that some eighteen months ago two Holland sleeping cars were put in service experimentally on the Illinois traction system; and we note with satisfaction that they have been so well patronized as to prove a paying investment. It has developed, however, that in future, because of the noise and vibration which they occasion, both motor cars and air pumps should not form the equipment of a sleeping car. Consequently, the two additional sleeping cars which the company has ordered will be trailers. The company believes that ultimately a profitable, low-fare sleeping car service will be established over the entire system and that it will prove to be profitable.

Because of their well-known fuel values, the immense deposits of peat have been the subject of considerable experimental work. Much money has recently been spent on the moors of Dartmoor and the Goss and Tregoss moors in England, in the attempt to convert peat into a marketable commodity on a large scale; a new Swedish invention is about to be tried in which the peat is first worked into a homogeneous pulp, and then heated, under pressure, to over 150 degrees Centigrade; after which the water is pressed out and the residue formed into briquettes. It is claimed that six pounds of the briquette will give as much heat as four or five pounds of good coal, and that the product will be considerably cheaper than coal.

A generating unit of novel design is being built for the Interborough Transit Company by the General Electric Company. One of the present 5,000 kilowatt reciprocating compound engines will be arranged to deliver its exhaust to a 5,000 kilowatt low-pressure turbine of the Curtis type. The turbine will be directly coupled to an induction generator, which will be connected to the leads of the reciprocating engine governor. There will be no governor on the low-pressure turbine, which will be controlled in speed by the generator, the latter being controlled by the governors on the reciprocating engines. It is expected that a far larger output will be obtained from this triple-expansion combination, as compared with that obtained from the reciprocating engine alone.

ELECTRICITY.

It is reported that the Erie Railroad will soon begin the electrification of its main line between Jersey City and Suffern. The plans are being drawn up and it is expected that electric trains will be run over this 32-mile section within a year.

A company has been formed to bore another tunnel connecting Switzerland and Italy. This tunnel will run through Mt. Blanc, starting at Martingly, in Switzerland, and coming out at Courmayeur, Italy. It will be 28 miles long and it is expected that it will be completed in three years.

One hundred thousand gallons of water sterilized by electrically-generated ozone are used daily by the Pittsburg Homeopathic Hospital. Dry air is passed through the ozonizers and the ozone produced is mixed with the water by means of aspirators. Three ozonizers are used for sterilizing water, while two provide ozone used for sterilizing instruments and bandages.

At the recent meeting of the American Street and Interurban Engineering Association of Atlantic City, a new system of street railway construction was proposed. The idea was to form the car wheels without flanges, but instead to place the flanges on the rails. The new construction was ably presented and many good arguments were brought forward to show the superiority of such a system over the present one.

A new process for making an insulator, according to the Electrical Review, has appeared on the Continent. It resembles ebonite and consists of a mixture of tan bark with one-third of sulphur. The whole is heated until the sulphur melts. The mixture is well stirred and then cooled, when it takes the form of small black grains. These are put in a pressure mold and heated, the result being a block of insulating material of any form.

According to the Electrical Journal there are twenty-eight single-phase roads in America, with 691.8 miles in operation, and 274.5 miles under construction. Abroad there are thirty-six single-phase railroads covering 771.05 miles with 57.75 miles under construction. The total number of single-phase locomotives in this country is fifty-seven and the number of cars 240, as against forty-three locomotives and 222 cars abroad. The total horse-power here is 137,-400, while the total of foreign roads is 64,160.

Recent experiments have been carried out in the German Reichsanstalt to show the effect of rolling on the magnetic properties of steel. The steel was found to be magnetically more efficient at right angles to the direction of rolling than parallel to the direction of rolling. The difference was quite marked. The investigations also showed that samples of sheet steel which had been annealed underwent great changes in a period of six months. The steel appeared to have deteriorated as far as its magnetic capacity was concerned.

The value of electricity for heating purposes is illustrated in a new electric glue pot which has recently been placed on the market. The economy of the device lies in the fact that the maximum amount of heat may be applied instantly when needed, while the glue may be kept warm at all times by a reduced flow of current through the heating coils. The glue pot consists of a cup in which the glue is placed, and which is set in a casing filled with water. The electric heater is attached to the pot immediately below the water. A hot-water receptacle is provided in which the brushes may be kept.

Electric generators were first adapted to be coupled to reciprocating engines, and hence were designed for comparatively slow speed. When it came to coupling the generator to a turbine it was necessary to operate it at a lower speed than was economical, so as to accommodate it to the slow-speed electro-generator. Recently generators adapted for high-speed service have been designed and a special type of turbine, known as the double-flow turbine, is used to operate these generators. There are several 10,000-kilowatt two-pole machines now under construction adapted to operate at 1,500 revolutions per minute.

The quartz lamp represents the latest development in mercury vapor illumination. It has been found that the mercury arc increases in efficiency up to a certain degree with the rise of temperature when incased in a glass tube. When a quartz tube is used instead of glass the temperature may be raised still higher because the quartz resists a higher degree of heat than does the glass. The new lamp consists of a tube from 2½ to 5 inches long and from 0.4 to 0.6 inch in diameter. The arc is started by tilting the tube so that the mercury will connect the two electrodes. The tilting is accomplished automatically by an electromagnet. Instead of the bluish light given in the glass tubes the quartz lamp yields a yellowish green light of much greater intensity, and a glass globe must be used over the quartz tube to protect the eyes from ultra-violet light. At the start the lamp absorbs 25 to 30 volts, but as the pressure increases the voltage rises to about 180.

AERONAUTICS.

Now that the Aeronautic Society has secured such a splendid place for aeroplane races as the Morris Park race track, the Aero Club of America (which is the chief aero-sporting organization of this country) should raise a large cash prize for an international aeroplane race, which could be held next spring, or some months before the race in France. This would keep America in the lead from both a practical and sporting point of view, and would be of the greatest benefit to the new science.

A considerable number of new cash prizes for aviation performances have been offered of late, the largest and most recent of which is one of $20,000 given by the Aero Club of France for a big aeroplane race to be held next fall in France. At Nice a cash prize of $2,000 will be put up for a similar race in the summer. In addition to the $50,000 cash prize for an aeroplane flight of 180 miles from London to Manchester, the London Daily Mail offers $2,500 for the first flight across the English Channel.

After making an excellent flight of nearly 3 miles in 4 minutes on the 3d instant with his monoplane, in the course of which he demonstrated his ability to make sharp turns, M. Bleriot once more suffered a fall from a height of some 60 feet on the 22d of October, when he was competing for a prize for height of flight. Too much gasoline fed to the motor caused it to lose speed and finally stop, after which the monoplane glided to earth. M. Bleriot managed to incline it so that the tail struck first and cushioned the shock. The machine was badly damaged, but the aviator was unhurt.

The Aero Club of America will conduct a contest for the SCIENTIFIC AMERICAN Trophy in connection with motorcycle races and the aeronautic exhibition and tournament of the Aeronautic Society at Morris Park during the afternoon of November 3, provided the weather permits, and also provided one or more machines capable of flying are entered. The Michelin prize of $4,000 for the longest flight in the year can also be competed for by any machine at this time. It is expected that aviator Curtiss will be present with the new tailless aeroplane of the Aerial Experiment Association, and that he will attempt to win both the SCIENTIFIC AMERICAN Trophy and the cash prize.

Less than three months ago Count Zeppelin's fourth airship was destroyed, yet so quickly and generously did the entire German nation come to his aid—$750,000 was raised—that he has already built the "Zeppelin V.," which made its initial flight above Friedrichshaven on the 23d instant. The press reports indicate that a successful flight was accomplished. The new airship carried 10 passengers and maneuvered for 3½ hours. It rose to a height of 600 feet and attained a speed of 29½ miles an hour. On the same day the "Parseval" military dirigible of Germany is reported to have dropped suddenly some 6,000 feet, owing to the bursting of the rearmost compartment of the envelope. A safe landing was made, and no one was injured. Our own government dirigible is being patched up at Fort Myer, the plan being to make some more practice flights with it before packing it away for the winter.

The net result of the three great balloon races held abroad on the 4th, 11th, and 12th instant has been the loss of two lives and the breaking of but a single record—that for length of time in the air. The Grand Prix race of the Aero Club of France, in which there were eighteen contestants, was won by the "Centauro," piloted by Georges Blanchet, which covered a distance of but 341⅓ miles. In the International race for the Bennett trophy (which, together with the endurance race the next day, was held at Berlin), there were 23 competitors. Four of these came down in the North Sea, and two balloons burst. The British "Banshee" was declared the winner, with a distance of but 270 miles. The Swiss balloon "Helvetia," piloted by Col. Schaeck, broke the endurance record by 20 hours, remaining aloft 74 hours, and only landing when it was towed six miles to the island of Kristiansö, near Norway, against the will of its pilot. This island is only 210 miles in an air line from Berlin, but the balloon altogether traveled nearly 800 miles, as it made a trip to Russia and back first. The Belgian "Belgica" covered 262 miles, and the French "Condor" 248. The American "St. Louis" came down in the North Sea some 238 miles from Berlin, and the French "Ile de France" and "Brise d'Automne" at a point 226 miles distant. Besides four balloons in this race, two of those in the endurance contest came down in the North Sea. The two men in each balloon were rescued in every case save in that of the German "Plauen," which was found drifting about occupantless, Lieut. Foertsch and his companion evidently having been drowned. Most of the balloons traveled around Berlin in circles for a day or more, after which they were blown north above the German Ocean. As a result of the failure of these races, and the dangers that developed, it is believed that next year dirigibles will be used.

THE KNUDSEN WIRELESS TYPEWRITER.

BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

An interesting development in wireless telegraphy has been perfected by Mr. Hans Knudsen, whose wireless system of telephotography was described a few weeks ago in the pages of the SCIENTIFIC AMERICAN. The feature of this latest appliance is that not only can it be operated in connection with any system of etheric communication, but it can be applied to any description of typewriter, whether having the full keyboard of 72 keys or the single keyboard with shift keys. The general design of the apparatus may be seen in the accompanying illustrations.

Taking the transmitter first: On the deck of the glass-paneled case in which the accumulators and driving mechanism are installed, is a table mounted on four columns, in the well of which the keyboard is placed. As for ordinary communication purposes, for which this invention is designed, only one type of character is absolutely necessary; the lower-case type is omitted, though it can be incorporated if required. By resorting to one case, however, the keys can be disposed in either one or two rows, together with the space key. The letters are alphabetically arranged.

The keys are somewhat similar in design to those of a piano, being about eight inches in length, and are mounted in the same manner in the frame upon pins. At the back of the keyboard frame is a crossbar formed with circular slots to receive vertically movable contact pins actuated by the rear ends of the type keys. There are as many slots and contact pins as letters. When a letter is depressed, it causes the other extremity of the key lever to rise and lifts the corresponding contact pin so that it projects about 3/16 of an inch above the level of the bar, thereby offering an obstacle to a traveling contact piece which passes longitudinally across the keyboard. The pins are held in their raised position by springs, so that they cannot return to the "off" position until struck by the traveling contact piece.

The four columns shown in the illustration serve as bearings to two rotating shafts at the front and back of the machine respectively, driven by an electric motor in the case. At each end of each shaft a small drum is mounted. Over each pair of drums travels an endless flexible steel band. This band is pierced at regular intervals by small perforations, into which mesh projecting points on the periphery of the drums, so as to secure a modified pinwheel drive. Upon this endless band are rigidly mounted two transverse carriages, from each of which projects downward the contact piece. These transverse contact carriages are so disposed that as one has completed its journey across the table, the other is just commencing to travel thereover, the direction being from left to right. As one contact bar is crossing the table the other is returning to the starting position under the table, and reappearing at the left-hand side as the other bar is disappearing at the right.

As these bars pass over the table, the small projecting contact piece strikes the elevated contact pins corresponding to the depressed keys, thereby completing the electrical circuit, and the impulse is transmitted through the coil and antennæ to the receiving station, where the letter corresponding to that contact pin is printed by the typewriter. When the carriage strikes a contact pin, it releases the holding-up spring, so that the pin returns to its normal or "off" position.

As soon as the traveling carriage has passed over the keyboard, it is momentarily arrested by a contact. This is the synchronizing arrangement, by means of which it is possible to keep the transmitter and receiver in perfect synchrony, as will be explained later.

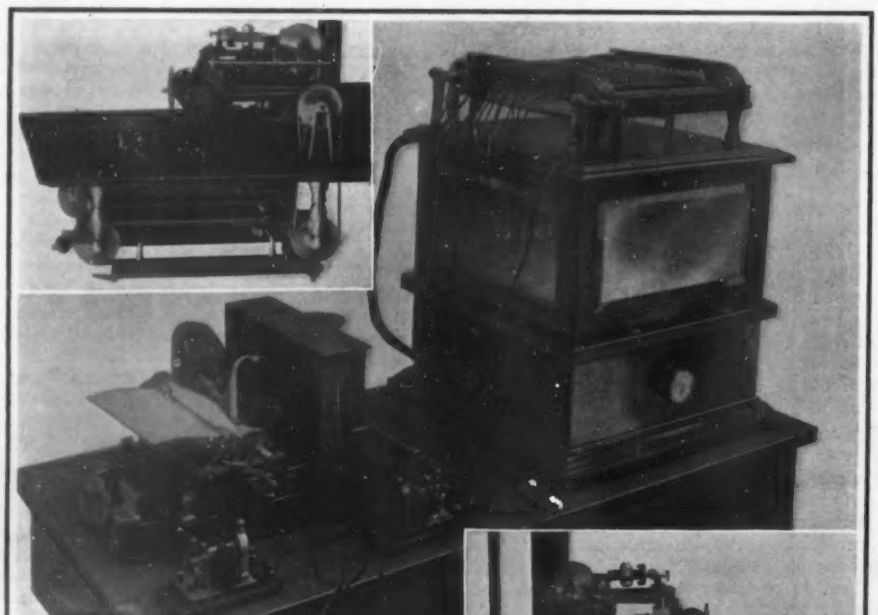
The operator depresses the keys in the time available between the two bars passing a given point, which task is considerably facilitated by the momentary stoppage of the traveler directly its journey across the table is completed, for synchronization. Suppose, however, the word *boyish* is to be transmitted. It will be observed here that after the *y* (twenty-fifth letter) has been struck, the operator has to return to *i* (ninth letter) followed by *s* (nineteenth letter) and lastly *h* (eighth letter). Should the whole word be written straight away, owing to the sequence of the pins and letters the resultant word *bhiosy* would be an unintelligible assembly of letters due to the printing of the letters in alphabetical sequence. To overcome this, the operator, after depressing the *y* (the final letter of the first syllable) allows the traveling bar to pass across the table; and before the second traveler makes its journey, he depresses *i* (ninth letter) and *s* (nineteenth letter), then allows the second bar to pass over, when the final *h* is depressed, and the succeeding traveling bar in its journey completes the transmission of the word in its correct form. From a description the process appears somewhat complicated, but in operation it is perfectly simple, since the operator continually works from left to right and never depresses a letter to the left of that last touched, until the traveling contact bar has passed over the table. As the speed of the traveling motion can be varied within very wide limits, the operator can transmit messages at a speed compatible with his ability.

Transmitter, showing contact piece which strikes pins of letters below.

Receiver, showing traveling carriages and brush contact.

In its general appearance and dimensions the receiver is very similar to the transmitter. There is a contact frame corresponding to the pin frame of the transmitter, only in this instance there are no projecting pins. Instead, the board comprises an insulated strip, into which are inserted narrow strips of metal, the surface of which is flush with the board. These contacts are spaced in precisely the same manner as the contact pins on the transmitter, and from each extends a wire communicating with the magnets of the corresponding type key of the typewriter keyboard. There is a similar endless band system carrying two traveling carriages. These are spaced precisely the same as the transmitter, only instead of a contact piece they carry a small brush, which sweeps over the inlaid contact pieces on the contact frame. The two instruments are in absolute synchrony. When the contact piece of the transmitter carriage strikes a pin, the brush of the receiver carriage is sweeping over the corresponding letter contact, and the impulse received by the coherer closes the circuit of the corresponding magnet, energizing the key on the typewriter, and thus printing the character. When the carriage of the receiver has passed across the table it is arrested, as is the carriage of the transmitter, and when the two are synchronized in position, an electrical impulse is automatically dispatched, releasing the carriages of the two instruments simultaneously. This system of synchronization constitutes the most important feature of the apparatus. The means by which it is accomplished are very simple. A countershaft is fitted to the electric motor mechanism of the transmitter, on which is mounted a magnetic clutch and braking gear. When the traveling contact carriage of the instrument has reached the extreme limit of its travel to the right, it strikes a ball and socket contact stop. This passes a current through the magnets, releasing the magnetic clutch, and at the same time applies a brake to the countershaft and traveling carriage, bringing it to an instantaneous dead stop and holding it firmly there, so that it cannot slip. The main driving mechanism, however, is uninterrupted. The traveling carriage of the receiver has similarly been brought to a standstill at exactly the same point of its travel. By an automatic device an electrical impulse is transmitted from the transmitter to the receiver, and simultaneously the two carriages resume their travel. Under actual working circumstances this stoppage is merely momentary; but should the operator wish to prolong the stop, he can easily do so by the movement of a switch, which exercises precisely the same effect without stopping the main drive. The automatic make and break is effected by means of a small fiber disk mounted on a small countershaft in the driving motor. This fiber disk carries a small contact, while on either side of its flat surface a thin brass flat spring presses.

When the disk revolves and brings the contact into connection with the metal springs, the current is dispatched through the synchronizing circuit, energizing the magnetic clutch gear and brake, the circuit being



The synchronizing mechanism. Motor mechanism of the receiver.

The receiver connected up to a typewriter.

THE KNUDSEN WIRELESS TYPEWRITER.

interrupted again directly the revolving contact has passed the flat springs.

Upon the keyboard of the typewriter itself is placed a small box carrying the magnets by which the keys are actuated. A wire extends from each contact of the contact frame of the receiver to its corresponding letter on the typewriter keyboard. The magnets are of special design, having long cores, and this mechanism being incased within a small box can be easily and instantly withdrawn from the typewriter keyboard when desired.

By means of a magnetic clutch and a ratchet the typewriter is automatically moved forward the desired distance, and the carriage returned to the left to commence a new line.

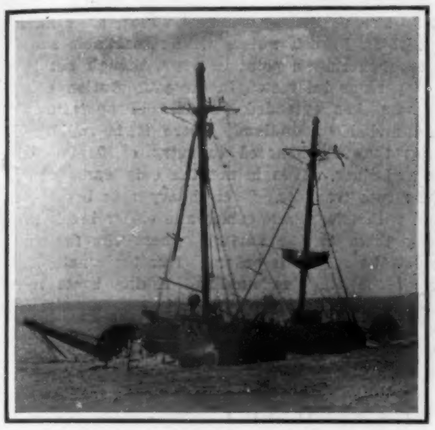
We understand that a contract has been made for raising the cruiser "Yankee," which recently went aground at Spindle Rock, by the same system which was used in the salvage of the large steamship "Bavarian" of the Allan Line. The method consists in rendering the lower deck watertight and driving out the water by forcing air into the lower hold.

SALVING THE WRECKED BRITISH CRUISER "GLADIATOR."

BY PERCIVAL HISLAM.

After five months of almost uninterrupted work, the British protected cruiser "Gladiator," which was run down by the American liner "St. Paul," has been raised and towed into dock. The disaster occurred on April 25 last in the Solent, during a blinding snowstorm, the cruiser proceeding at a speed of about nine knots and the liner, according to the evidence of Capt. Passow, at about 14 or 15 knots. Two courts were held in England as a result of the wreck. In the civil court it was decided that the "St. Paul" was in no way to blame for the accident; but the naval court martial which tried Capt. Lumsden, the commander of the "Gladiator," decided that there were extenuating circumstances. The court found "that the charge was partly proved, and that the prisoner hazarded his ship by default, and not by neglect." The sentence passed by the court was as follows: "The court, having found the charge against the prisoner partly proved, and taking into consideration the difficult position in which he was placed by the 'St. Paul' not complying with Articles 15a and 16 for the prevention of collisions at sea, and also taking into consideration that all possible steps were taken by the prisoner to prevent loss of life and the high state of discipline of the officers and men under his command, adjudges him to be reprimanded and dismissed H. M. S. 'Victory'" (to which ship he had been appointed on the loss of the "Gladiator"). It should be mentioned that the articles referred to deal with the signals to be made by ships during foggy or misty weather—the blowing of sirens, etc., and with the speed at which they should proceed.

The wrecked cruiser was a vessel of 5,750 tons, built in 1896 at a cost of $1,500,000. Her armament consisted of ten 6-inch and fourteen smaller weapons, and her speed, obtained with engines of 10,000 horse-power, was 19.1 knots on trial. She is not, it will be seen, a very useful vessel, judged by modern standards, particularly in the matter of speed. Her nominal complement is 23 officers and 424 men; but at the time of the accident she was attached to the home fleet, and manned with a nucleus crew of 13 officers and 257 men. One officer and 28 men were lost in the collision, some being thrown overboard and drowned by the force of the impact, some being drawn down ex-



The "Gladiator" righted. The derrick, now nearly horizontal, may be seen on the left, and the "camels" on either side.

General scene during the attempt to right the "Gladiator." On the extreme right a tug is supplying compressed air to the "camels" after the water has been pumped out. The "camels" are lashed to the under side of the wreck.

Preparing for the final effort to right the wreck. Powerful tugs hauled on the derrick, which can be seen projecting vertically from the side of the wreck.

Bow view of the wrecked cruiser, taken in the basin at Portsmouth dockyard.

A deck view of the "Gladiator" after she was righted. The pumps were working almost continuously up to the time she was docked

The British protected cruiser "Gladiator" as she appeared when in commission. Displacement, 5,750 tons. Speed, 19 Knots. Ten 6-inch guns.

SALVING THE WRECKED BRITISH CRUISER "GLADIATOR."

hausted in an attempt to swim ashore, and a few being caught by the bows of the liner as they crashed into the cruiser's side.

Immediately after the collision the "St. Paul" went astern, and the captain of the "Gladiator," seeing that his vessel was listing heavily to starboard—on which side she was struck—headed her for the shore of the Isle of Wight. Here she was safely beached, but almost immediately turned right over until she lay, with masts and funnels completely submerged, at an angle of about 93 degrees with the vertical.

In this position the ship offered no obstruction to traffic; but the British authorities decided at once to salve her. At first it was thought possible that this might be effected with the appliances at the disposal of the Admiralty; but after two or three days' work, during which the light guns, boats, and all the portable fittings were removed from the deck, it was decided to give the work to a private company. The contract was awarded to the Liverpool Salvage Company.

The first thing done was to send divers down into the ship to close as many watertight doors as possible, in order to isolate the damaged portion. The salvage company sent two special ships, and several tugs and lighters were supplied by the Portsmouth dockyard authorities, with the result that in a short time nine pumps, capable of pumping from 600 to 850 tons of water an hour, were at work on the wreck. Those furnished by the company were the most powerful, and these can be seen in some of the accompanying photographs. They were of the motor type, operated by gasoline.

The next difficulty encountered was that of the tides. These flow at a very rapid rate through the Solent, and round the shores of the Isle of Wight, where the "Gladiator" lay, often reaching a speed of five knots. As the ship lay at right angles to the shore, stern foremost, the full force of these currents was felt, and it was therefore decided to get the vessel broadside on. To this end, two powerful steam winches were erected on shore, special concrete foundations having to be laid for them. Strong wire hawsers were laid to the bows of the ship, but at the first attempt at hauling, they gave way under the strain. Before another effort was made, a number of steel "camels" were constructed in the dockyard to assist in the work. These are huge water-tight cylinders, 100 feet long and ten feet in diameter. They were sunk round the bows of the wreck, the water was pumped out, and a supply of compressed air was kept up, enabling them to exert a lifting force of 200 tons each. With these camels giving such great assistance it was not long before the ship was brought into the desired position, and the salvage party were then able to proceed with the work of getting the ship on an even keel.

This proved to be the most difficult task of all, for the ship had been lying so long that she had made a bed for herself in the muddy bottom. The divers had not been able to prevent the ingress of water, with the result that the pumps had to be kept continuously at work; indeed, they scarcely ceased from the time the operations were commenced to the moment when the vessel was lying safely in dock. Bad weather, too, interfered considerably with the work, and it was only after a dozen unsuccessful efforts that the vessel was at last got upon an even keel. The difficulties attending the operations will be appreciated from the photographs accompanying this article. The camels played a very important part in this phase of the work, which was assisted by powerful derricks hauling on the top-sides and on the masts of the wreck.

After the righting, the rest was comparatively simple. Divers were able to construct a wooden cofferdam round the damaged parts, and the pumps were thus able to keep the water well under. The camels were then sunk again and made fast to the ship by 8-inch hawsers, and the pumps were transferred to the deck of the ship.

The final efforts to get the vessel clear of the bottom were commenced early on October 1, but ended in disappointment, as by the end of the day she had developed a dangerous list, and seemed likely to collapse into her original position again. However, the operations were resumed on the following day, and on October 3 the ship came up and was finally towed off the bank on which she had so long rested.

Needless to say the ship presented a sorry spectacle. Her funnels and topmasts were gone, and her deck, although clear of the usual impedimenta of a warship, was a scene of chaotic confusion. Astern, the name was out of the water, but amidships there was only about eighteen inches clear, while the hull was begrimed with mud, and huge cascades of water were pouring over the sides, ejected from the interior by the powerful pumps. She still had a slight list to starboard, and on that side four of the camels were attached. Two tugs were lashed to either side. It was dark before the procession was able to get under way and head for Portsmouth harbor, and it was a sight never to be forgotten by those who saw it. A government tug led the way, and a cable's length behind her came a swarm of small craft with the disabled hulk of the wrecked cruiser in their midst. The moon was shining brightly, and several of the tugs had powerful searchlights at work to illuminate the ship for the benefit of those at work on her. Thus the cruiser was taken into the harbor.

She was allowed to settle down in the mud for the night, and two days after she was raised again and taken into the basin, and finally into the dock. It was then possible to see the extent of the damage. It had been thought the "St. Paul" struck her an almost direct blow, but this was at once shown to be impossible. From a little forward of amidships the entire side plating from the upper deck right down to the keel has been cut away for a length of over forty feet, most of the plating being folded back against the side abaft of the aperture. All the decks are left bare, but the decks themselves have not been crushed in, but are intact right up to the aperture. It is obvious, therefore, that the liner must have struck the cruiser a glancing blow, and not a direct one.

The intentions of the Admiralty with regard to the future of the "Gladiator" have not yet been made known. A detailed report will be forwarded, and from this they will decide what is to be done with her. As the reconstruction will cost at least half a million dollars, it is not thought that she will be brought forward for service again, as her small fighting value would not justify such an expenditure. She will probably be broken up.

Prizes for Improvements in the Manufacture of Ferro-boron.

The committee of the Society of Chemical Industry, consisting of Messrs. Isakovics, Roeber, and Baekeland, appointed to draw up the regulations governing the competition for the award of the Pacific Coast Borax Company's prize of $500, have submitted the following report:

The sum of five hundred dollars has been paid to the American Electrochemical Society, and deposited in trust, as a research fund, to be awarded as a prize for improvements in the commercial method of manufacturing ferro-boron, by a direct process, from colemanite.

It is essential that the process should be sufficiently economical and suitable to be applied on a large scale, so that the finished product may be available for commercial purposes. (Commercial ferro-boron, as now made, contains 20 per cent or more of boron, less than 3 per cent of carbon, and sulphur and phosphorus are practically absent.)

Competitors are notified that they must comply with the following conditions:

1. The treatise must be typewritten, and accompanied by a sample produced by the process described in same. It must be inclosed in a plain, sealed envelope, not bearing the author's name, but identified by a pseudonym. The outside of the envelope, containing the paper, must be labeled with the pseudonym, and with it should be sent another plain sealed envelope, also labeled with the same pseudonym, which should contain inside the envelope the name and address of the competitor. Both these envelopes should be sent to Prof. Morris Loeb, 273 Madison Avenue, New York.

2. All papers competing for the prize must be in the hands of Prof. Loeb before October 1, 1909. Prof. Loeb shall retain the small sealed envelope, containing the address of the competitor, and forward the large envelope containing the treatise, as well as the sample of the product, both merely labeled with the pseudonym, under cover, to the secretary of the American Electrochemical Society, to be submitted to the board of directors, who will award the prize. The competitors for the prize forfeit none of their property rights in the process submitted.

3. As soon as the board of directors has agreed upon the best treatise, it will request from Prof. Loeb the address of the author thereof, who will then be required to demonstrate his process, before the prize will be finally awarded.

4. The Pacific Coast Borax Company, 100 William Street, New York city, has offered to supply anyone who desires to compete for the prize seriously, with all the crude colemanite that the parties making the experiment may require, provided that the request for this colemanite be accompanied by a letter signed by one member of the board of directors of the American Electrochemical Society, indorsing the application for the material. Information will be furnished to prospective competitors on application to the American Electrochemical Society.

Barcelona has, perhaps, one of the best and most complete electric tram services in Europe, some 156 miles of line being worked by the different companies within the boundaries of the city and suburbs; none of these concerns, however, are British enterprises, the whole system being controlled by German and Belgian syndicates. During the past year about 12½ miles of new rails have been laid, mainly in completion of small branch lines in several of the more important streets. The overhead trolley system is the only one employed. A service of motor omnibuses has been started running from the suburb of Gracia to the central square, "Plaza de Cataluña," by a Catalan company, but as yet the "taxicab" has not made its appearance.

Telegraphic Cables Endangered by Modern Fishing Methods.

In the last few years a great change has taken place in the methods of fishing with trawls or drag nets. Small nets drawn by fishing boats have given place to great machines towed by steamers. Steam trawlers originated in England. They have multiplied rapidly and now France possesses a fleet which, after having been tried in French waters with remarkable success from the fishermen's point of view, though not from that of persons interested in the preservation of marine fauna, has extended its field of operations to Iceland and Newfoundland, where it is rapidly destroying the time-honored industry of fishing with hooks and lines. This is not the only damage done by the steam trawlers. Their heavy nets become entangled with telegraphic cables and either break them or drag them to the surface, where the fishermen often cut the cables in order to free their nets. The hooks of the old Newfoundland fishing boats never inflicted any such damage, for they were not dragged along the bottom, and if a hook happened to foul a cable, the line simply parted and the hook was lost, while the cable remained uninjured.

As the steam trawlers mark wide furrows on the sea bottom in every direction they cannot fail to encounter the cables and break them, to the great injury of the cable companies and their service. It has cost the Commercial Cable Company $100,000 to repair the damage caused by trawlers in three months. In May last there was an almost daily interruption of service on some one of the thirteen cables which connect America with Europe, and these interruptions occurred 40 miles from shore in the waters frequented by the trawlers.

The cable companies demand laws prohibiting trawling in the vicinity of their cables, and the fishermen complain that the cables interfere with their work and damage their nets.

Death of Dr. F. A. C. Perrine.

Dr. Frederic Auten Combs Perrine, well known as a consulting engineer and authority on electrical science, died in his home in Plainfield, N. J., after a long illness. He was forty-six years old.

Dr. Perrine was born in Manalapan, N. J., and was educated in the Freehold Institute. He was graduated from Princeton in 1883, and later received a diploma from the scientific department. After holding the positions of manager of the insulated wire department of the John A. Roebling's Sons Company and treasurer of the Germania Electric Company he became a professor in electrical science at Leland Stanford University. From 1898 to 1900 Dr. Perrine was chief engineer of the Standard Electric Company of California, and in 1900 he was made president of the Stanley Electrical Manufacturing Company, in Pittsfield, Mass. He retired in 1904 to become a consulting engineer, with offices in this city. He was editor of the Journal of Electricity, in San Francisco, from 1894 to 1896, and also of Electrical Engineering, in Chicago, from 1896 to 1898. He wrote "Conductors for Distribution."

The Current Supplement.

The current Supplement, No. 1713, opens with an article by the English correspondent of the Scientific American on the "Flip-Flap," a new amusement apparatus which was one of the sensational side shows at the Franco-British Exhibition. George E. Lynch writes on the operation of coal-cutting machinery. The production of high-frequency oscillations is discussed by no less an authority than William Duddell, to whose indefatigable investigations we owe so much. Edward Hausbrand contributes an article on a new method of desiccation, in which he describes an apparatus which has demonstrated its efficiency in the condensation and desiccation without injury of milk and many pharmaceutical substances easily decomposed by heat. Perhaps the most important article in the Supplement is an elaborate account of the Wright aeroplane, in which the construction of that wonderful flying machine is described in detail. Many illustrations elucidate the text. Monsignor Talon in a little work entitled "The Marvelous Story of the Traditional Picture of Jesus," gives an interesting version of a tradition which dates from the time of the Apostles. The tradition is in part translated in the current Supplement. Illustrations of early portraits of Christ are published. Among the minor articles may be mentioned those entitled "Stereoscopic Projection," "Artificial Silk," "The New Map of Greenland," "Apparatus for Measuring the Heat of the Sun," and "Our Losses by Fire."

Correspondence.

COLOR BLINDNESS.

To the Editor of the SCIENTIFIC AMERICAN:

May I call attention to a sentence from the article on Color Blindness in your issue of August 15, as bearing on some work done by me in the course of my color investigation? The sentence is as follows: "When you see that stream of red in the sky, what does he see at the same place? Something beautiful, no doubt, something he calls red as well as you. But is his red your red?"

You further say: "These are questions which cannot be answered now, and perhaps science may never be able to do so."

The difficulty which has hitherto blocked the way has been the want of a mechanical standard color scale correlatable to color sensations in such a way that the sensation can be recorded in terms of common understanding.

The difficulty is now entirely solved by means of a series of graded colored glass standards, which are made mechanical by being brought into color accord with such physical color constants as definite percentages of given thicknesses of potassium bichromate, potassium permanganate, copper sulphate, etc. Two feet of distilled water is suitable for the very light shades.

It follows that when one gives a name to the sensation excited and matched by a given standard, it is at once comparable with the name and value of the standard itself, which has been already correlated to a physical color constant, and can be recovered by its means.

The method of applying this system of defining a color sensation to the quantitative measurement of color blindness can be best illustrated by actual examples. The following five have been selected as typical from twenty-eight cases tested in my own laboratory:

EXAMPLES OF FIVE QUANTITATIVE MEASUREMENTS OF COLOR BLINDNESS.

	Units of Color Depth.	Red.	Orange.	Yellow.	Green.	Blue.	Violet.	Neutral Tint.
To A vision.	1	White.	White.	White.	Dirty White.	Quite White.	Might be Blue or Red.	Dirty.
	5	Red or Blue, not a Yellow.	Might be Red, Green or Brown.	Think it Green or Yellow.	Very little depth at all.	Blue because like the sky.	Blue or Red.	Light Brown.
	10	Pink, don't know.	Brown or Green.	Green or Yellow.	Brown or Yellow.	Blue or Purple.	Blue or Lake.	Gray or Light Black.
	15	Think a Pink, a shade darker than pure White.	Yellow, Green or Brown.	Green or Yellow.	Brown.	Blue or Purple.	Blue or Purple.	Deep Red.
	20	Dirty, no color.	Red, Green or Yellow.	Green or Yellow.	Brown, might be Green	Blue or Purple.	Blue or Purple.	Black.
B vision.	1	Yellowish.	Yellowish tinge.	Yellow.	Cannot name.	No color.	No color.	....
	5	Yellowish.	Yellow.	Bright Yellow.	Yellowish or Bluish.	Blue.	Blue.	....
	10	Bluish.	Deep Yellow.	Deep Yellow.	Greenish.	Blue.	Blue.	....
	15	Bluish.	Deep Yellow.	Deep Yellow.	Greenish, anything.	Blue.	Blue.	....
	20	Dim Blue.	Deep Yellow.	Deep Yellow.	Greenish.	Blue	Blue.	....
C.	1	Red.	Orange.	Light Yellow.	Green	Blue.	Violet.	....
	5	Reddish.	Yellow Green.	Light Yellow.	Reddish.	Blue.	Blue.	....
	10	Light Red.	Yellow Green.	Yellow.	Red.	Light Blue	Deep Violet.	....
	15	Confused Gray.	Orange Green.	Yellow.	Confused Red.	Blue.	Deep Violet.	....
	20	Gray.	Orange Red.	Yellow.	Confused Green.	Blue.	Deep Violet	....
D	1	Light Red	So-called Red.	Really Red.	Really Red.	Light Blue.	Bluish with tinge of Red.	....
	5	Red.	Reddish Orange.	Orange	Really Red.	Blue.	Blue.	....
	10	Reddish Blue.	Really Red.	Yellow tinge of Orange.	Red.	Blue.	Blue, unmistakably.	....
	15	Red.	Red, mere Orange.	Red or Yellow.	So-called Red, might be Green.	Blue.	Very Dark Blue.	....
	20	So-called Red deep color.	Yellowish.	Pure Orange.	Red	Dark Blue.	Blue.	....
E.	1	Pink	Green.	Green or Orange.	Pink.	Pink.	Blue.	....
	5	Blue or Pink.	Green.	Yellow.	Red.	Blue.	Blue.	....
	10	Blue or Pink.	Dark Red.	Yellow.	Yellow and Dark perhaps Blue.	Blue.	Blue.	....
	15	Green.	Dark Yellow, or Green or Red.	Yellow.	Orange or Green.	Blue.	Dark Blue.	....
	20	Deep Red with Blue in it	Orange.	Yellow.	Dark Red.	Dark Blue.	Very Dark Blue.	....

The standards are selections from my color scales, and the intensities used by me are of 1, 5, 10, 15, and 20 unit values in the six spectrum colors—red, orange, yellow, green, blue, and violet. These color depths range from a very light to the darkest shade. The color names on the table are of medium depth (about 10 units). The exact language used by the examinee in describing the colors submitted has been written in full as being of suggestive value.

The apparatus consists of a frame with six windows, which can be filled with the color standards, either single, together, or in contrast at the will of the examiner. They should, however, never be submitted in their order of rotation.

The number of examples is insufficient for a scheme of classification, but admits a preliminary division into three classes, viz., normal, abnormal, and color blind.

The normal and color blind need no comment; they speak for themselves. The abnormal is here of two varieties; first, those having a faint perception, such as B for green, and D for red; second, those who cannot distinguish between two colors, but are normal for one of them, such as B for yellow and the whole five for blue and violet. I am now at work on a plan of determining which is the true sensation.

Referring to your sunset method of illustration, the sunset reds or the color of any other meteorological phenomenon can be measured, recorded, and reproduced.

It is evident that the value of this method depends on the true division of the color scales, and the correlation of their unit values to physical color constants, which enables their verification in any laboratory. In support of this, the international juries of the St. Louis Exposition in 1904 awarded a silver medal for the scales, and two bronze medals, one for pathological and the other for chemical research. They are also in use in over one thousand laboratories without their accuracy being questioned.

JOSEPH W. LOVIBOND.

The Color Laboratories, Salisbury, England.

FIRE-CONTROL MASTS.

To the Editor of the SCIENTIFIC AMERICAN:

In reading naval articles in the SCIENTIFIC AMERICAN and other papers, I notice a general satisfaction and pride over the fact that the United States has stolen a march on the other powers with respect to the new spiral tubular masts for fire control, which we are about to place on all of our ships both in commission and building.

No one denies that the day of the heavy military mast with fighting tops is past, and that in the future the masts of warships are to be only for the purpose of signaling, and perhaps for the fire-control station. Also this spiral tubular basket mast, which was so thoroughly tested under fire on the monitor "Florida" (now "Tallahassee") is conceded to be a success by naval officers. But before we rush blindly ahead, and place a lot of these lattice affairs on our ships, why not question the policy of other powers? England has been using a tripod mast on her new ships, beginning with the "Dreadnought," for two years. This type of mast, with one vertical and two slanting steel tubes, appeared, with differences as to height, on the old Peruvian battleship "Huascar." Now the British naval constructors have doomed the tripod mast, the last ship carrying it being the cruiser-battleship "Indomitable." The masts now in use will not be removed, but on all future vessels there will be only a couple of pole masts for the signals and wireless. I have not heard what type is to be placed on the German, Brazilian, and French "Dreadnoughts," but Italy is to have only the pole mast, and even the Japanese battleships "Aki" and "Satsuma" are equipped with two of this type.

Now the question arises, Where is the control station to be located? The vessels must have a central fire-control station; and although I have heard nothing about this important point, I think it likely that a bridge will be erected running breadthwise between the funnels or at any commanding point on the superstructure. This will, I think, serve as a station even better than a mast; for while it will command the whole horizon without interference, and be high enough above the water, owing to the greater freeboard of future ships, it will not be subjected to such heavy fire, or be in danger of being destroyed, as it would if located on a mast of any kind. What, then, is the use of the United States spending so much money over this new mast, when other nations are getting the same results with a safer and cheaper type? The time to check this is now; not after the masts are built. It is as foolish as the act which authorized the "Mississippi" and "Idaho," obsolete before launching, a clean waste of over $12,000,000, and now these two ships are to be the first to receive this lattice-work mast. Better leave bad enough alone, and let the military masts stand, than put up this expensive basket mast. We ought to place pole masts on all of our new ships, and on old ones too if any tearing down is to be done; and I would certainly like to know the reason for this spiral mast policy and the disadvantages, if there are any, of the British and Japanese type.

Masts, like all top hamper, are at their best undesirable, but until a method is discovered of placing the wireless and fire-control range finders under cover while still commanding the entire horizon, the pole mast and, as I think, probable midship bridge of the British "St. Vincent" are infinitely superior to the large, costly, spiral-tubular masts of the American "Delaware."

HAROLD M. KENNARD.

Brooklyn, N. Y., October 5, 1908.

[We do not agree with our correspondent in his statement that a bridge amidships would afford a better location for the fire-control platform than an open-work mast of the kind used in the "Florida" tests. In the long-range fighting of the future, the gunners will aim as near as possible at the center of the ship, where our correspondent proposes to place the bridge. The lattice mast would stand more hits before being wrecked than a bridge built upon the superstructure. One shell might wreck a pole mast; it would take several to bring down a lattice mast.—ED.]

CURIOUS FACTS ABOUT NUMBERS.

To the Editor of the SCIENTIFIC AMERICAN:

In an article which appeared in the SCIENTIFIC AMERICAN, March 28, 1908, page 222, under the heading "Curious Facts About Numbers," quite an importance was attached to the fact that any cube may be expressed as the difference between two squares.

In two particulars the teaching (by inference) seems to be misleading, first, in that the article would almost certainly lead to the conclusion that this is a property of numbers which is peculiar to cubes only. This is not so stated, but seems to be implied. The fact is that any number (or all numbers) can be expressed by the difference between two squares,

$$\text{as } 129 = 23^2 - 20^2$$
$$132 = 34^2 - 32^2$$

Second, it is misleading in that the conclusion is almost inevitable that the pair of squares indicated by the formula is the only pair whose difference is the cube desired. The truth is that most cubes, and in fact nearly all numbers, can be expressed in this way, by any one of several pairs of squares,

$$\text{as } 129^3 = 1073345^2 - 1073344^2$$
$$129^3 = 24983^2 - 24940^2$$
$$129^3 = 8385^2 - 8256^2$$

The explanation of the fact that any number is the difference between two squares, is so simple that it would seem to be almost useless to give the proof. Probably you are acquainted with the fact.

In the article referred to, at the conclusion of the argument, you state that $129^3 = 16770^2 - 16512^2$. This is an error probably caused by failure to follow all the steps indicated in the formula. It should read $129^3 = 8385^2 - 8256^2$.

FRANK NEWCOMB.

Beeville, Texas, September 21, 1908.

Remarkable changes have occurred in Morehouse's comet. The tail has become greatly condensed. On October 1 the comet was faint and without a tail. Yet on September 30 and October 2 it was distinctly visible. On the later date the tail was broad, fan-shaped on one side, with three shorter tails below it.

THE MANUFACTURE OF INCANDESCENT GAS MANTLES.

BY JACQUES BOYER.

The original Welsbach mantle was produced by incinerating a cotton or woolen fabric impregnated with solutions of the nitrates and acetates of lanthanum, yttrium, and zirconium. The inventor soon added to these salts the oxide of thorium, which enormously increases the luminosity. This invention marked a notable advance in the art of illumination, but the mantles, being mere gossamer tissues of ash, were exceedingly fragile. In recent years many attempts have been made to improve the texture and composition of incandescent mantles, in order to diminish their fragility. The latest improvements in the manufacture of these delicate contrivances are described and illustrated in this article.

The modifications adopted by the Hella Company, of Paris, are designed especially to increase the strength of the mantles. For this purpose the top of the mantle is surrounded by a metallic cap, which offers great resistance to fracture. The result is a great increase in the life of the mantle. Furthermore, as the photographs show, nearly all the operations of this new establishment, which controls the patents of M. Wasmuth, are performed by machinery. The tubular fabric of the Hella mantles is made from ramie fiber on knitting machines of the usual type. It comes to the Paris factory thoroughly washed, in lengths of 7 or 8 inches. These are first placed in perforated jars of coarse earthenware, which are plunged into vats containing a solution of the nitrates of thorium and cerium, and the vats are put into an oven in which, in the final stage of the process, a vacuum can be established, in order to force the solution into the fibers.

After impregnation the mantles are passed through a wringing machine composed, essentially, of two rollers covered with ebonite and soft rubber and adjusted to give any desired clearance by means of a system of screws and spiral springs. The solution which is pressed out of the mantles is caught in shallow earthen dishes placed under the rollers, which are turned either by a hand crank or by power transmitted by a belt and wheel. The wet mantles are carried to the rollers by an endless belt, on which they are laid, snugly, by the girl attending the machine. The pressing or wringing must be performed in a smooth and regular manner in order to prevent the formation of wrinkles, which would cause inequalities in strength and speedy fracture. As the mantles emerge from between the rollers, on the opposite side, they fall on an inclined plate of glass, from which a second operative takes them up and lays them in a porcelain dish.

On leaving the wringer each mantle still contains about 5 grammes (77 grains) of the impregnating solution. It goes next to an operative who reinforces the upper end by brushing it with a solution of nitrate of zirconium, aluminium, glucinium, or magnesium. The reinforced mantles are laid on wooden gratings to dry, and are finally stretched over conical glass forms mounted, in groups of 20, on boards, which are placed in large chambers heated to 122 deg. F., where they remain until the mantles are completely desiccated.

From this stage onward the manufacture of the Hella mantles differs radically from the ordinary process. Instead of sewing the top of the mantle to a fiber of asbestos, for the purpose of fixing it to the nickel support, it is attached to a metallic mounting consisting of two parts, the head and the netting, both of which are composed of an infusible alloy. The mounting is attached with the aid of the "capping machine" shown in one of the photographs. The operative places the netting, and then the mantle, on a mandrel, and raises the latter until the top of the mantle is at the level of a set of needles which, on being brought together, "gather" the fabric. The head

Fig. 4.—Capping machines.

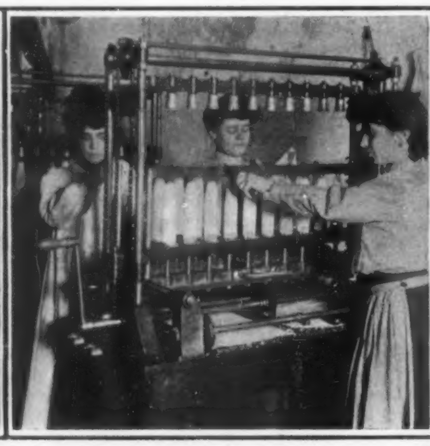


Fig. 5.—Shaping machines.

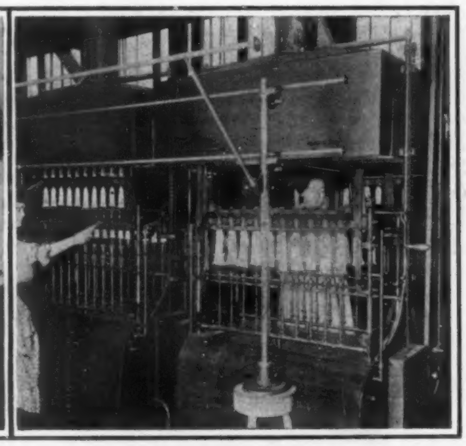


Fig. 6.—Incinerating machine.

Fig. 1.—Impregnating the mantles with collodion.

Fig. 3.—Reinforcing the mantles.

Fig. 2.—Wringing the mantles to remove the excess solution.

THE MANUFACTURE OF INCANDESCENT GAS MANTLES.

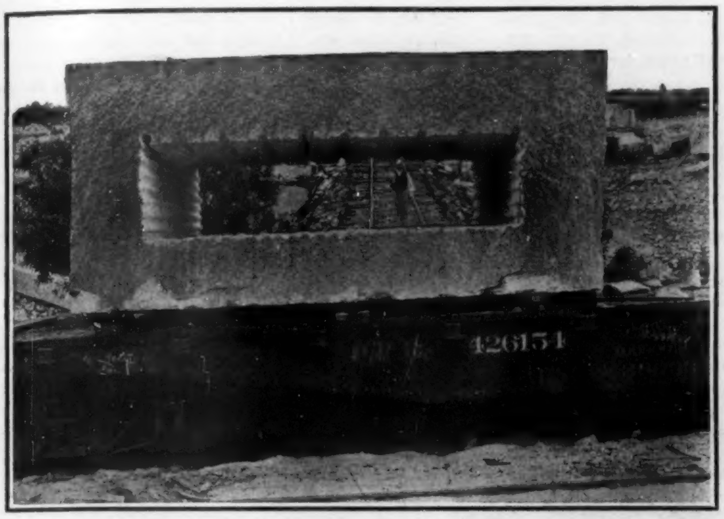
is then put on, and the mantle is clamped between two metal rings by pressing a lever. With this machine one woman can cap, or mount, 2,000 mantles in a day of nine hours.

The mounted mantles then go to the shaping machine, where they are put on forms and brushed by revolving brushes, which stretch them uniformly and press them closely to the forms, while their metallic heads are forced into hoods which compress and tighten them.

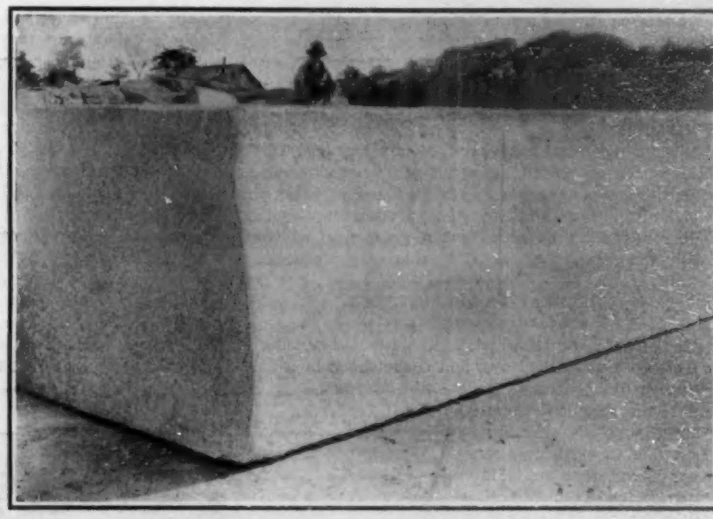
Ten mantles at a time are lifted from the ten forms of the shaping machine by a rod and conveyed to the incinerating room, which, from the technical point of view, is the most interesting and original part of the establishment. By the employment of cams the incinerating machine automatically performs several successive operations. After the fiber of the mantle has been consumed by the first ignition, the head of the mantle is decarbonized, and at the same time reinforced by the application of a flame of compressed gas, which reduces the nitrates of thorium and cerium to oxides. The burning of the interior follows. The burners ascend and descend five times inside the mantles, and give them their final form. The tops of the mantles, which were impregnated with an additional quantity of nitrates in the reinforcing process, are subjected to still another firing. The photograph shows, above the burners, a ventilator, which is lowered before the machine is started, so that it surrounds the burners and carries off all the products of combustion. The ventilator opens the gas cock as it descends and closes it as it rises. In the illustration the ventilators of the machines are raised, in order to show the interior. The entire process of incineration occupies about three minutes, and is applied to 20 mantles simultaneously.

The incinerated mantles are impregnated with collodion, in order to make them less liable to breakage in packing and transportation. This process, also, is effected by a machine, which executes all the necessary movements by means of cams, the mantles being supported by rods carried on endless chains and dipped in a trough of collodion about six feet long. The mantles then go to a drying room heated to about 110 deg. F., through which they are carried on endless chains in a circuitous path. The journey occupies half an hour, and terminates at a clipper which, operated by a woman by means of a crank and a lever, trims the mantles at the bottom to the desired length.

During the entire process of manufacture, the Hella mantles are never touched by the hands of the operatives. Even after they have been trimmed, they are lifted with rods for conveyance to the packing room, where a simple machine suspends each mantle in its carton in such a manner that it is perfectly protected from shocks, and can be shipped with safety to any distance. In use also these mantles appear to be stronger and more durable than those hitherto employed.



The die for the Washington monument, Brooklyn, in the rough. Weight over 60 tons. Cored out to reduce the weight.



View of an enormous ledge, showing the seam at the bottom made by the "lifting process."

THE "LIFTING PROCESS" IN THE QUARRYING OF GRANITE.

BY L. B. WARD.

Rocky masses in great abundance are to be found in North Carolina, some of its mountains being almost solid rock. The section of country at and around the vicinity of Mt. Airy is composed almost entirely of these rock masses. The Mt. Airy quarries are situated on a hill many acres in area, very gradual in slope and practically bare of vegetation, composed of a solid, homogeneous mass of moderately hard granite, which shows no ledges or bed planes whatever. Near these quarries is Stone Mountain, about 1,000 feet high and four or five miles in circumference, a huge mass of granite similar to the Mt. Airy quarry lands, with the same scant vegetation.

The fact that these masses of stone show no ledges or bed planes whatever, and split readily and in straight lines in any direction, is taken advantage of to create artificial beds to work on. Large laminations or sheets of granite are separated from the mass at a single "lifting" operation, by successive use of powder and compressed air.

The "lifting process" is causing much interest and attracting attention throughout the world.

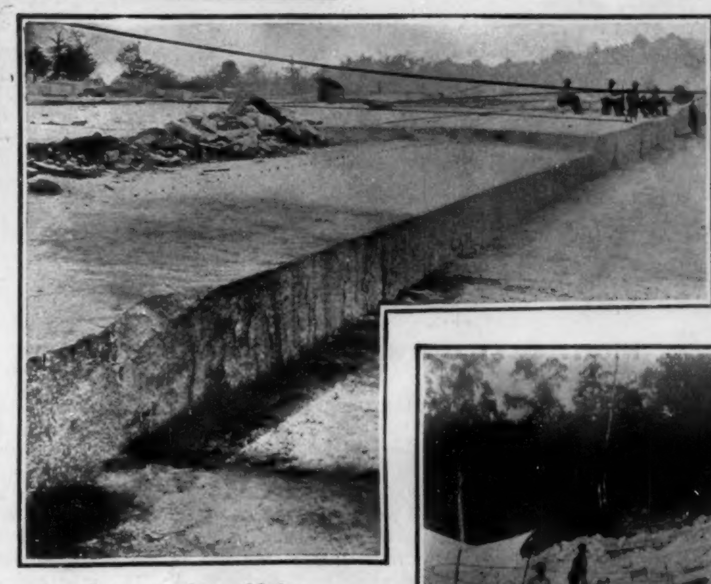
This process is applicable to quarries of large horizontal areas and in solid masses, and such conditions being almost ideal at the Mt. Airy quarries, the "lifting process" is altogether used. The tremendous advantage afforded by "lifting" can be readily understood, as by means of a "lift" granite of any desired area and of definite thickness can be made available for surface work and drilling.

The largest stone required for any possible construction could be produced thus; the weight of the larger stones now produced has to be reduced to the capacity of the largest equipment furnished by the railroads, by coring.

At the central power station in the quarries are two huge water-tube boilers, each of 210 horse-power. These supply steam to the air compressor, which has a capacity of 3,000 cubic feet of free air per minute. This air is conducted by six-inch pipe lines running the entire length of the quarries. Lead lines distributing it to all parts of the quarries, make it available at all points for "lifting," as well as for use with pneumatic tools.

In the center of the area to be lifted, a drill hole two or three inches in diameter is sunk six or eight feet in depth (according to the required thickness of the stone). The bottom of the drill hole is enlarged into a pocket by

Ordinary ledges of varying thickness.



A common form of ledge.

A "lift" being split and drilled into required widths and lengths.

THE "LIFTING PROCESS" IN THE QUARRYING OF GRANITE.

exploding a half stick of dynamite; a handful of powder is then exploded in the pocket thus formed. This starts a horizontal crack or cleavage across the greater diameter. The charges of powder are now increased in size, and are exploded in the cavity, the drill hole being plugged at every blast to confine the gases and cause constant force upon the stone, until the crack has extended 75 or 100 feet in all directions from the lift hole. A pipe is then cemented into the hole, and connected with the air pipe line of the air compressor by means of a globe valve, and is used gradually to admit compressed air at between 70 and 80 pounds pressure until the crack or cleavage extends until it becomes visible in a thin edge out on the hillside.

Sheets of several acres and of any required thickness can be so "lifted," thus affording a bed plane to which quarrymen can work, drilling and splitting the stone into proper sizes for the purposes required.

It can readily be seen that a great deal of time, labor, and expense are saved by this unique process.

THE HEAVENS IN NOVEMBER.

BY HENRY NORRIS RUSSELL, PH.D.

Morehouse's comet, which at the time of writing is visible with the naked eye, and conspicuous in a field-glass, will continue in sight throughout November, though diminishing somewhat in brightness as it recedes from us. Its apparent path is almost directly southward, through Lyra and Aquila. On October 25 it is close to the star γ Lyræ, on November 7 near ζ Aquilæ, and on November 30 near λ Aquilæ. These three stars are shown on our map, and with their aid it will be easy to find the comet.

At present it shows a nebulous head, without any well-defined nucleus, and a long, nearly straight tail, brighter in comparison with the head than is usually the case. At least this was its telescopic appearance two nights ago. Last night (October 15) the tail was conspicuously distorted and bent. Whether this remarkable change is due to some change in the emission of the fine particles of which the tail is composed, or to interference with their motion after leaving the head, or some such thing as collision with a swarm of meteors, no one can say yet.

It is to be hoped that many photographs of the comet will be obtained at this interesting time, for their study may help us to explain these strange phenomena.

The comet is still approaching the sun, and if it follows the usual behavior of such objects, we may expect that its tail will increase in length and brightness. It will be well worth the careful study of both the amateur and professional astronomer as long as it remains visible in our skies.

By the end of December it will be apparently very near the sun. Indeed, it will very nearly pass behind it about January 1, and after that date it will be visible only in the southern hemisphere, where it will probably be observable for some time.

THE HEAVENS.

The great square of Pegasus, whose acquaintance we made last month, is now almost overhead. Its western side points downward toward the bright star Fomalhaut, far below, near the southern horizon. On the way we pass by Aquarius, west of which is Capricornus, with its pretty double star α. The eastern side of the square, carried down, but not so far, points out the planet Saturn, which is in Pisces only a few degrees from the vernal equinox, the point from which the right ascensions of all the stars in the sky are measured.

Below Saturn, about as far again, in the same line, is an isolated star of the second magnitude, β Ceti. The rest of the constellation to which it belongs may be identified upon the map. The variable Mira has now passed maximum, but is still visible to the naked eye, though fading steadily. In the east the forerunners of the winter constellations are in sight. Taurus is pretty well up. The cluster of the Pleiades, and the more extensive group of the Hyades, which includes the bright star Aldebaran and the V-shaped group near it, once identified, cannot be mistaken.

To the left of Taurus is Auriga, with the very bright yellow star Capella. Below these Orion and Gemini are rising, and above them are Perseus and Aries. Andromeda is still higher, and the great nebula (shown on the map) is almost exactly overhead—not the most convenient place for observation, though theoretically the best.

Cassiopeia and Cepheus are between the pole and the zenith. Ursa Minor and Draco are below the pole on the left, and the Great Dipper lies close along the northern horizon.

In the west Cygnus is high up, with Lyra below it, and Hercules setting in the northwest. Farther south is Aquila, with the small groups of Delphinus and Sagitta above it. This is at present the most interesting region of the sky, for it is here that we may look for the comet—as already described.

THE PLANETS.

Mercury is morning star in Virgo and is well placed for observation around the time of his greatest elongation on the 13th. At this time he rises about 5 A. M. and is well clear of the horizon before dawn. The bright star Spica is about 10 deg. west of the planet, and rises forty minutes earlier; but Mercury is much the brighter of the two, and may be distinguished by this, as well as by his position.

Venus is also a morning star, and in Virgo, but rises earlier, not far from 3:30 A. M. She is now more than 100 million miles from the earth, but is still brighter than anything else in the sky.

Mars is likewise a morning star and is not far from Venus. She is moving eastward faster than he, and on the 30th she overtakes him, and passes north of him, distant little more than one degree.

Jupiter is in the morning sky too, but rises earlier than the others—about 1 A. M. in the middle of the month.

Saturn alone of the conspicuous planets appears in the evening sky. He is in Aquarius, and comes to the meridian about 9:30 P. M. on the 1st and 7:30 on the 30th.

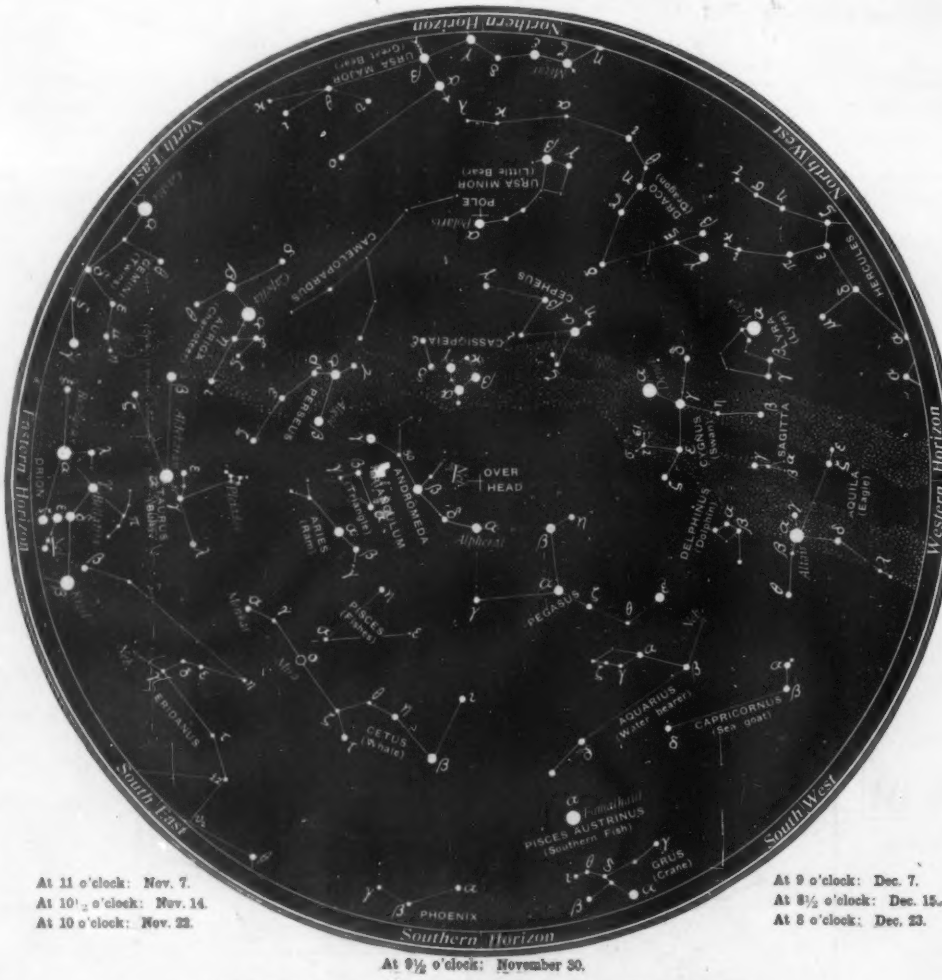
Uranus is in Sagittarius, too far south and too near the sun to be observed, though technically he would be called an "evening star." Neptune, which is in Gemini, comes to the meridian about 3 A. M. and may be observed in the morning.

THE MOON.

First quarter occurs at 9 A. M. on the 1st, full moon at 3 A. M. on the 8th, last quarter at 7 P. M. on the 15th, new moon at 5 P. M. on the 23d, and first quarter again at 5 P. M. on the 30th. The moon is nearest us on the 4th and farthest off on the 16th. She is in conjunction with Saturn on the 4th, Neptune on the 12th, Jupiter on the 17th, Venus and Mars on the 20th, Mercury on the 22d, and Uranus on the 26th.

It may be added that the Leonid meteor shower is due as usual on the mornings of November 15 or thereabout. But there is no reason to expect much of a display this year, so it will not be worth sitting up to see.

Princeton University Observatory.



At 11 o'clock: Nov. 7.
At 10½ o'clock: Nov. 14.
At 10 o'clock: Nov. 22.

At 9 o'clock: Dec. 7.
At 8½ o'clock: Dec. 15.
At 8 o'clock: Dec. 23.

At 9½ o'clock: November 30.

NIGHT SKY: OCTOBER AND NOVEMBER

THE YUMA IRRIGATION DAM.

BY DAY ALLEN WILLEY.

Within the next year, one of the most notable projects connected with the reclamation of arid lands in the Southwest will probably be entirely completed. While the work includes the storage of water on a large scale, and its distribution by means of irrigating canals, the extraordinary difficulties encountered by the engineers in building the necessary dam and in restraining the rivers in the vicinity, have made the undertaking unique among the irrigation enterprises.

In a recent issue, a feature of the Yuma project as it is termed was described in the extensive levee work required to confine the channels of the Gila and the Colorado rivers during high water, to prevent the reservoirs and canals from overflowing during floods, also to check the movement of sediment carried in such enormous quantities when the streams are at high-water mark. The formation of the embankments by means of abatis made from young trees and brushwood holding the earth embankments, also the jetty system for retarding the flow of the water, were detailed and illustrated. Another problem necessary to be solved, however, was how to create a permanent reservoir of sufficient size for irrigation purposes, strong enough to resist flood action, and so constructed that it would not be shallowed or filled with the sediment. The great variation of the volume of water in the Colorado and the depth of the mud and other detritus on its bottom above rock strata added to the difficulty. A dam across the river was essential, but the question was how to build it so that it would not be washed out, or at least partly demolished. Could it be erected on a solid foundation, and could its ends be securely anchored in the formation on either side?

Preliminary surveys for the general project were made early in 1904. Several different locations were also examined to determine the best place for this structure, and a search was made for bedrock with diamond-core drilling machinery, at all possible dam sites between Yuma and Picacho. As a result of these explorations, the Laguna weir site was selected as the most desirable one for the construction of a weir to serve the lands near Yuma, a high dam and high-line canal being considered impossible. The type of weir selected is one that has been tried during the last fifty years at numerous places in India and Egypt under similar conditions, three dams having been constructed on the Nile River within the past fifteen years, on practically this same plan, all having served their purpose efficiently and being in operation today. This type of weir consists of a loose rock structure with a paving of stones 1½ feet in thickness on the downstream slope, the structure being tied together with three parallel walls of steel and concrete run longitudinally between the granite abutments on the two sides of the river, the entire structure being further made secure by an apron of loose rock pitching 10 feet in thickness and 50 feet in width at the [illegible] toe of the dam below the sloping pavement. The

height of this weir was to be 19 feet above low water, and the slope of the downstream side 12 feet horizontal to 1 foot vertical, with 50-foot apron below. The design called for the upper core wall of concrete to rest upon a row of sheet piling driven into the bed of the river.

The handling of the silt of the Colorado is one of the most difficult features of this undertaking. It is known that its amount is very large. The river is on a grade of approximately one foot to the mile above the Laguna weir site, so that this weir will make a settling basin of relatively quiet water approximately ten miles in length above it. At each end of the weir, and constructed in solid granite rock, is a sluiceway 200 feet wide excavated to the depth of low water in the river. These sluiceways are closed by large gates operated by hydraulic machinery. The diversion canals for irrigation take their water above these gates from the sides of the sluiceways. The area of the sluiceways being so great, the water movement toward the canal is slow, and most of the sediment is deposited. It is estimated that the capacity of the sluice gates will be approximately 20,000 cubic feet per second each. This great volume of water passing through the sluiceways when the gates are open, will

The headworks as designed are of rock, concrete, or steel, with the exception of the sheet piling, which is driven entirely below the water level, and so will not decay. Every portion of the weir is of what is known as permanent construction.

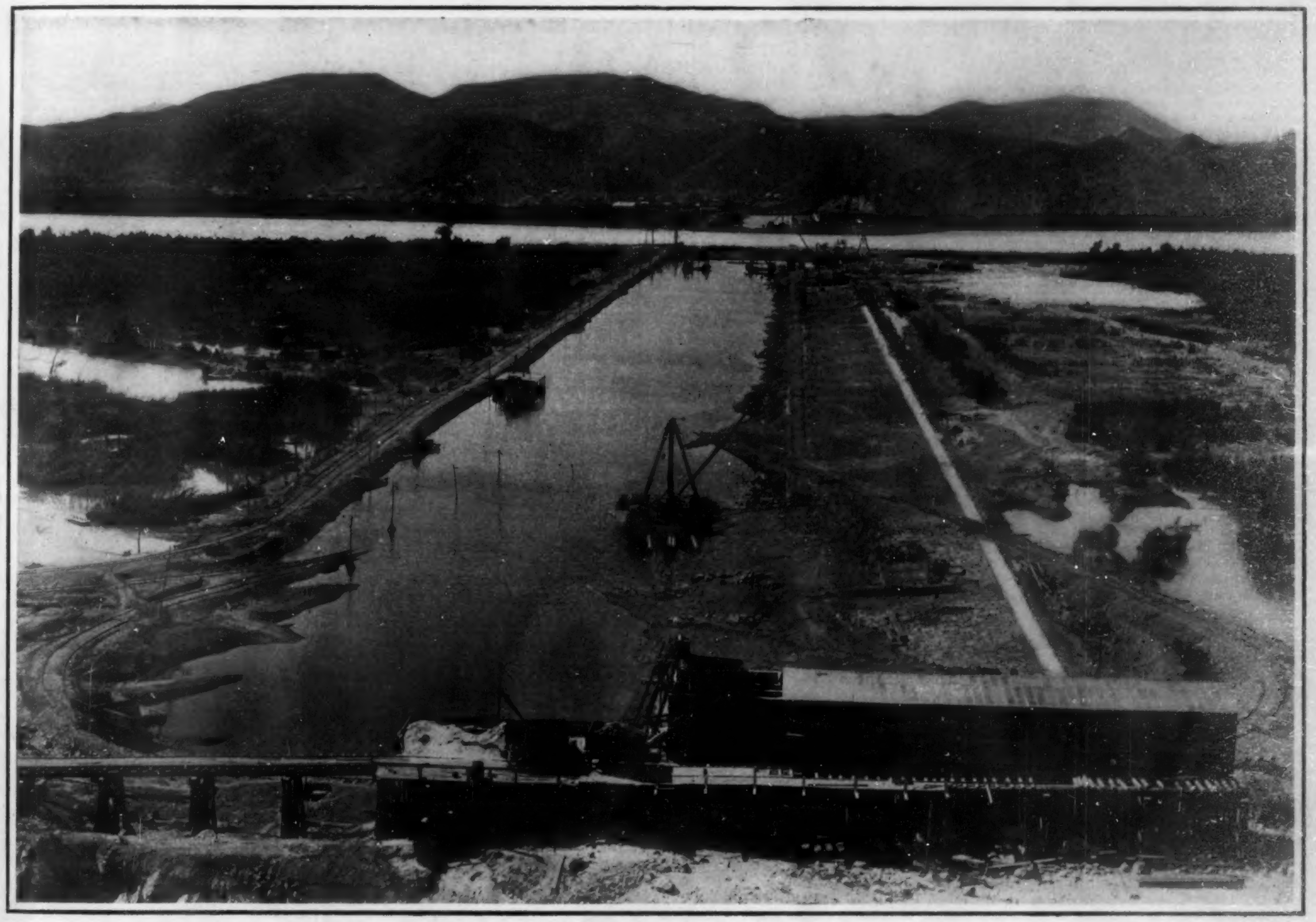
The accompanying photographs show the enormous proportions of the Laguna dam and the variety of work required in the preparation of the foundation and later construction. While 4,780 feet, or nearly a mile, in length, its width is especially noticeable, the maximum dimension being no less than 272 feet, although the height as stated is but 19 feet. These proportions are necessary, however, because of the great force of the flood current, and to prevent the water from forcing its way beneath the dam and thus undermining it.

The capacity of the canals at their intakes is 1,200 cubic feet per second on the Arizona side, and 200 cubic feet per second on the California side. The amount of the silt that would be daily delivered into the Arizona canal, if diversion were made directly from the structure, would approximate 17,000 cubic yards of wet mud by volume.

Careful study was made of the existing canals in the vicinity of Yuma and Imperial, to determine the shape that they naturally assume, and the roughness

water in the ground so near the surface, it was considered necessary, for their permanent safe irrigation, to supply a drainage system. A main drainage canal has been designed to run through the central portion of the areas to be irrigated, and when possible the natural drainage lines of the country have been utilized, deepening them with a stream dredger to such depth that they will carry off the water returning from irrigation or seeping through the levees during the high-water stage of the river. When lands in any district tend to become alkaline they may be connected, by means of local drainage canals, with this main drain, and in this manner they can be kept free from alkali by holding down the level of the ground water. During the greater portion of the year, when the river is low, this drainage water is discharged into the stream; but when the river is in flood, its elevation is such as to prevent the discharge into it from the drains. A pumping plant has, therefore, been designed to lift the drainage waters from the levees during the flood period of the river to prevent the lands becoming waterlogged.

The total cost of the works will be about $3,000,000, but they will irrigate 100,000 acres all told by means of 26 miles of main canals and 138 miles of laterals.



Dam partly completed. Note top of core wall, and, in right foreground, the stone paving.

THE YUMA IRRIGATION DAM.

carry out with it the sediment deposited above the intake of the canals. The ordinary low-stage flow of the Colorado River is from 3,000 to 4,000 cubic feet per second, so the capacity of each of these sluiceways will be about five times the low-water flow of the river. The figures are given for purposes of comparison only.

As the result of a number of experiments, it has been found that the principal quantity of silt is carried along near the bottom of the river, and that the surface water is relatively free from sediment. It was planned, therefore, to take the water into the canals by a skimming process over a long row of flashboards, so that the entire capacity of the canal can be furnished by drawing but one foot in depth of water from the surface of the river. As a still further precaution, it was decided to construct the first 3,000 feet of canal on each side of the river of such size that the movement of water through it will be slower than one foot per second. These settling basins, as they are called, will be either excavated from granite, or, where the section is in earth, they will be paved. At the lower end of the settling basins, gates were planned to discharge into the river, so that the water could be drawn down to the level of the stream.

of the bottom and sides, which tends to retard the velocity. Based upon these data, the new canals have been so designed as to carry water at a higher velocity throughout than will be found in the settling basins above their head, and at such velocity as will permit of a minimum loss by seepage and evaporation. The gates and drops of these canals and the Yuma bridges are steel concrete structures. One of the most difficult problems in connection with this project was the crossing of the Gila River. It was considered necessary to make this perfectly safe, and for this purpose a structure was designed that crossed beneath the bed of the river, the top several feet below the lowest point of the stream bed. This structure is of steel and concrete, and some 3,000 feet in length.

The shape of levee adopted was one that has been developed by years of experience along the Mississippi River. It has a slope of three feet horizontal to one foot vertical on the water side, it is eight feet wide on top, and built five feet above the highest water marks of the year 1903. These levees are 4,000 feet apart (one on each side) along the Colorado River, and 3,200 feet apart along the Gila River.

Because the lands are so flat, and the level of the

The most interesting feature, however, from an engineering point of view is the successful control of a stream whose volume of water may rise and fall to the extent of thirty feet in a week, flowing through a channel of soft silt which it has been accumulating for centuries.

Cement from Blast-furnace Slag.

An invention which should have far-reaching effect upon the Portland cement industry, and which incidentally will enable a hitherto useless product to be turned to commercial advantage, has recently been perfected by Mr. Sherard Cowper-Coles, the well-known English electro-metallurgist. This invention consists of the direct production of cement from blast furnace slag. The latter is taken when still molten as it issues from the furnace, and conducted to an electric furnace, where its temperature is further increased. During this period a predetermined quantity of chalk is added to the slag, and the whole then subjected to electrolysis, which brings about certain reactions producing a Portland cement equal in strength and quality to the best grades obtained by the existing methods, at a very small cost as compared with the generally adopted process and in practically one operation.

RECENTLY PATENTED INVENTIONS.

The Inventions described in this Department were Patented through the Scientific American Patent Agency.

Electrical Devices.

AUTOMATIC FIRE-ALARM TRIP.—F. A. KEHL and A. F. WRIGHT, Tacoma, Wash. The device is designed to put into operation a fire-alarm box by pulling down its operating lever whenever an electric circuit is closed to the electromagnetic devices forming part of the invention. It is designed more especially to be used in connection with sprinkling systems and such fire protection systems as are employed in large factories where it is important that the fire department shall be apprised of the fire at the earliest possible moment in addition to the protection afforded by the sprinkling system.

ELECTRIC BURGLAR ALARM.—S. H. HESS, New York, N. Y. The invention relates to an improved alarm which is sounded whenever a person attempts to break into a room through the windows, doors, and transoms, or if he attempts to interfere with the alarm bell. The bell will continue ringing until a person knowing the particular combination and possessing a proper switch key arrives to stop it.

Of General Interest.

POST HINGE FOR WATER CLOSET SEATS, COVERS AND THE LIKE.—G. A. GEARY, New York, N. Y. The invention provides an improved post hinge for water closet seats, covers and like articles, arranged to hold the seat normally in a raised position. The construction allows of swinging the seat or cover to a closed position, but will return it to normal position when released.

WINDOW.—W. J. SUMMERBELL, Chicago, Ill. The frame of this window is constructed of a number of layers of material, an outer and an inner layer of fireproof material, preferably hard asbestos board, and an intermediate layer of reinforcing, ordinarily sheet metal, the whole being secured together by bolts with the nuts located on the inside.

PNEUMATIC CUSHION INSOLE.—W. L. GORDON, Deal, N. J. This pneumatic insole is designed to provide a good cushioning effect at the heel and operates at the same time to ventilate the forward portion of the shoe. When pressure is brought to bear upon the heel air is forced forward under the toe of the insole.

Heating and Lighting.

DEVICE FOR CREATING A CENTRAL DRAFT FOR FIREBOXES.—G. F. PANNEBAKER, St. Louis, Mich. The purpose of this invention is to provide an attachment for the fireboxes of stoves, furnaces, grates, etc., which will operate to create a draft within the body of the fuel whereby the latter will be completely consumed, and the heat will be thrown from the center of the stove outwardly to the sides.

Machines and Mechanical Devices.

CLUTCH.—F. M. NICHOLS, Chillicothe, Ohio. This invention is an improvement in clutches, consisting of a construction which is easy to operate and which can readily be moved into and out of the clutched position. The operation of the device is aided by the provision of anti-friction mechanism.

AGITATOR FOR WASHING MACHINES.—J. ST. C. JAMES, Hiawatha, Kans. The agitator consists of several cone-shaped hollow bodies open at their outer ends and connected together at their smaller or inner ends. These are attached to a shaft which is so mounted that it may be rotated and lifted or lowered at will. In operation, as the agitator is lowered the water is moved toward the center of the tub, and when the agitator is lifted the water returns to the periphery of the tub.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending October 20, 1908,

AND EACH BEARING THAT DATE

[See note at end of list about copies of these patents.]

Account system, H. Wilke 901,507
Accounting system, E. C. Albree 901,579
Acids, producing hydroxy-fatty, G. Imbert. 901,905
Adjustable bracket, I. Filson 901,700
Advertising bill book, W. Hornich, Jr. 901,901
Agricultural tractors or the like, anchoring device for, J. E. W. Fillet 901,799
Air brake, J. F. McElroy 901,923
Air compressor, H. J. Horstmann 901,344
Air compressor, T. O. Perry 901,555
Air compressor, multiple stage, J. G. Leyner 901,539
Air self-coupling, B. F. Sweeney 901,660
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Inquiry No. 8650.—Wanted to buy file cutting machinery.

FOR SALE.—Patent No. 892,934. An improved nut lock or triangle detaining washer that is destined to fill a long-felt want. Very cheap and simple. Ask for sample. For particulars address J. F. Huffman, 969 Leon Place, Memphis, Tenn.

Inquiry No. 8667.—Wanted to buy needle, pin and pen machinery.

FOR SALE.—Patent for gas stove for America and England and one for kerosene oil. For full particulars address Louis Wendnagel Lamp Extinguisher, 22d and Jefferson Streets, Chicago, U. S. A.

Inquiry No. 8685.—Wanted to buy 1¼ to 2-inch No. 13 to 18 tempered spring steel.

PATENTS WANTED.

WANTED.—Information regarding good patent which would be money maker. Only inventor, who wishes to sell outright or on royalty basis, need answer. Give price and brief description. L. Darbyshire, Box 390 A, Rochester, N. Y.

Inquiry No. 8687.—Wanted to buy motor plows.

HELP WANTED.

WANTED.—10,000 railway mail clerks, city carriers, post office clerks appointed yearly, $600 to $1,600. Many examinations coming. 25 free scholarships. Franklin Institute, Dept. W P, Rochester, N. Y.

Inquiry No. 8699.—Wanted to buy two-stranded soldered wire for heddles.

PRINTING.

PHOTO-GELATINE PRINTING for art, advertising and scientific work, effective and lasting. Also artistic commercial printers and makers of souvenirs and premiums. Barton & Spooner Co., Cornwall-on-Hudson, N. Y.

Inquiry No. 8701.—Wanted to buy solar engines.

MOTION PICTURES.

THE MOVING PICTURE WORLD, weekly, 10 cents per copy; yearly subscription, $2. The only paper devoted to the moving picture, illustrated song and lantern lecture field. Moving Picture World, Box 450, N. Y.

Inquiry No. 8721.—Wanted unwelded tubing that is used for structural work.

LISTS OF MANUFACTURERS.

COMPLETE LISTS of manufacturers in all lines supplied at short notice at moderate rates. Small and special lists compiled to order at various prices. Estimates should be obtained in advance. Address Munn & Co., List Department, Box 773, New York.

Inquiry No. 8735.—For parties making a still for the purpose of extracting alcohol from saw-dust.

A LIST OF 1,500 mining and consulting engineers on cards. A very valuable list for circularizing, etc. Price $15.00. Address Munn & Co., List Department, Box 773, New York.

Inquiry No. 8736.—For manufacturers of machinery for making matches, also machinery for making purses and hand bags.

MISCELLANEOUS.

UNITARIAN LITERATURE, including sermons and weekly publications, sent free, on application to Miss Peck, 168 George Street, Providence, R. I.

Inquiry No. 8737.—For manufacturers of machinery for making tooth-brushes, shaving brushes, galvanized water buckets, locks, nibs and holders.

WANTED.—Ideas, theories, literature, or information of any kind on gravitation, considered from an electro-magnetic standpoint. Also patents granted, if any, on machinery having even a faint connection with the subject. Address José B. Rionda, The Tuinucú Sugar Co., Tuinucú, Cuba.

Inquiry No. 8742.—For manufacturers of water still, also of thermometer tubing.

WANTED.—Mechanism to rupture, dry and pulverize starch in starch grains. For particulars address Wm. Zimmerman, 1,010 Tribune Building, Chicago.

Inquiry No. 8748.—Wanted to buy polished or lacquered brass in sheets 29 gauge, quarter hard in temper.

Inquiry No. 8749.—For makers of very large springs, used for running machinery.

Inquiry No. 8769.—For manufacturers of an appliance to attach to the old style razor blade to make same a safety razor.

Inquiry No. 8770.—For parties who make short link twist chains, links from ⅛ inch up.

Inquiry No. 8771.—Wanted to buy tune sheets for Criterion music boxes.

Inquiry No. 8774.—For machinery for making bags from sisal hemp.

Inquiry No. 8775.—Wanted to buy stock novelty or jewelry catalogues.

Inquiry No. 8779—For parties manufacturing gas, gasoline, steam engines and boilers; also packing and mineral wool, steam supplies, iron and lead pipe, power transmission machinery and steam fitters' tools.

Inquiry No. 8780.—For parties who make gasoline stoves.

Inquiry No. 8784.—For manufacturers of alcohol burners for lights and stoves.

Inquiry No. 8786.—For parties to manufacture glass balls blown about 1¼ inch in diameter with a ⅛ inch hole through the center, should hold about 200 pounds to the square inch of steam pressure.

Inquiry No. 8787.—For parties who manufacture cat-gut.

Inquiry No. 8790.—For the manufacturer of "Brooks improved hand pump."

Inquiry No. 8792.—For a firm that manufactures glass holders made of glass.

Inquiry No. 8796.—For concerns manufacturing stills adapted to the manufacture of denatured alcohol.

Inquiry No. 8798.—For manufacturers of micro lens used in small articles such as pencils, charms, etc.

Inquiry No. 8799.—Wanted to buy new or second-hand box nailing machine for small packing cases.

Inquiry No. 8800.—Wanted complete data in regard to pegamoid.

Inquiry No. 8802.—Wanted to buy machinery for cutting and polishing oilstones, whitestones or grindstones.

Inquiry No. 8803.—For manufacturers of files, screws, druggists' supplies, hardware in general, and agricultural machinery.

Inquiry No. 8804.—For parties dealing in windmills, wood split pulleys, wheelbarrows, cutlery and picks.

Inquiry No. 8805.—Wanted to buy outfits and supplies for brazing.

Inquiry No. 8806.—For manufacturers of drawing materials.

Inquiry No. 8807.—For dealers in second-hand cotton machinery.

Inquiry No. 8810.—For makers or importers of porous water bottles or jars to cool drinking water by evaporation.

Inquiry No. 8811.—Wanted to buy electric tattooing needles, inks and stencils.

Inquiry No. 8812.—Wanted to buy outfits for manufacturing fuel briquettes from sawdust.

Inquiry No. 8813.—For manufacturer of the "Steele" mixer for mixing food products, etc.

Inquiry No. 8814.—Wanted to buy hand lever air pumps, 100 lbs. pressure.

Inquiry No. 8815.—Wanted to buy carriage and wagon hardware coal, iron and steel.

Inquiry No. 8819.—For manufacturers of Excelsior Welding Compound.

Inquiry No. 8821.—Wanted to buy machinery for making a rough composition board, something like a straw board.

Inquiry No. 8822.—For manufacturers of dredging machinery to be operated by gas engine.

Inquiry No. 8825.—For manufacturers of a new device to split wood.

Inquiry No. 8826.—Wanted to buy small fuel compression machines both manual and engine power.

Inquiry No. 8827.—For manufacturers of annealed glass.

Inquiry No. 8829.—Wanted to buy machinery for making pins, hair pins, hooks and eyes.

Inquiry No. 8830.—Wanted to buy machinery for making brushes and baskets.

Inquiry No. 8831.—Wanted to buy knitting machines.

Inquiry No. 8832.—Wanted addresses of high-grade label weavers, preferably in New York.

Inquiry No. 8833.—Wanted to buy a peanut shelling machine.

Inquiry No. 8834.—Wanted to buy a 2-horse-power gasoline engine for spray wagon working on hilly ground.

Inquiry No. 8835.—Wanted to buy toothpick machinery.

Inquiry No. 8836.—Wanted to buy decorticating machines for sisal.

Inquiry No. 8837.—Wanted to buy folding umbrellas.

Inquiry No. 8838.—Wanted to buy metallic targets similar to clay birds used in shot-gun shooting.

Inquiry No. 8839.—Wanted to buy cheap automobiles.

Inquiry No. 8840.—Wanted to buy portable hydrocarbon pressure lamps.

Inquiry No. 8841.—Wanted to buy lunch counter and restaurant fixtures.

Inquiry No. 8842.—Wanted to buy annealed glass.

Inquiry No. 8843.—Wanted to buy cigarette making machine.

Inquiry No. 8844.—Wanted to buy inkstands.

Inquiry No. 8846.—Wanted to buy an electric butcher hand saw.

Inquiry No. 8847.—Wanted laundry tubs.

Inquiry No. 8848.—Wanted to buy rust proof metal for parts of wash tubs.

Inquiry No. 8849.—Wanted addresses of Canadian makers of rifle sights.

Inquiry No. 8850.—Wanted to buy machinery for making canvas gloves or mitts.

Inquiry No. 8851.—Wanted to buy machine for weaving wooden lath and wire together.

Inquiry No. 8852.—Wanted to have made a concave brass or copper reflector with focus of four or five feet.

Inquiry No. 8853.—Wanted to buy wafer safety razor blades.

Inquiry No. 8854.—Wanted to buy air compressor pressure up to 1,500 lbs., the capacity ranging 500 to 3,000 cubic feet.

Inquiry No. 8855.—Wanted machine to punch holes, feed and set automatically solid copper rivets and washers and rivet together harness done with one stroke.

Inquiry No. 8856.—Wanted a machine or grinder for reducing soft wood refuse to a fine dust.

Inquiry No. 8857.—Wanted addresses of shoe string manufacturers.

Inquiry No. 8858.—Wanted to buy comb cleaning machine.

Inquiry No. 8859.—Wanted to buy steel gray paint suitable for gasoline engines.

Inquiry No. 8860.—Wanted to buy machinery for grinding, washing and drying gum chicle.

Inquiry No. 8861.—Wanted to buy machine for cutting out mittens.

Inquiry No. 8862.—Wanted to buy a feather pillow ventilator.

Inquiry No. 8863.—Wanted to buy machine to separate pecan nuts into sizes and dust the dirt off.

Inquiry No. 8864.—Wanted manufacturers of mechanical novelties.

Inquiry No. 8865.—Wanted to buy fireless cookers.

Inquiry No. 8866.—Wanted to buy instantaneous water heaters.

Shade carrier, window, A. C. Van Erka 901,398
Sharpener, scissors, J. B. Carroll 901,522
Sheet metal, cutting, A. Benson 901,772
Sheet metal cutting machine, A. Benson 901,773
Sheller. See Corn sheller.
Shelves and tables, detachable auxiliary holder for, G. Eggi 901,598
Shoe, E. J. Lafond 901,353
Shoe for loggers, safety, G. L. Clement 901,880
Sign exhibiting device, changeable, J. J. Metzger 901,631
Signaling device, marine, M. Boyd 901,677
Signaling system, selective, O. W. Hart 901,441
Skillet support, H. C. Ebert 901,326
Skirt marker, A. M. Sutton 901,496
Skirt supporter, N. C. Edwards 901,327
Sled and brake therefor, bob, E. G. Doland 901,790
Sleigh, E. Ferriss 901,604
Sleigh, runner, attachable, J. E. Hobbs 901,342
Slicing machine, meat, W. A. Van Berkel 901,855
Smelting furnace, G. A. Wettengel 901,405
Smoking pipe, W. R. Kaufman 901,915
Snowstorm, device for producing the representation of a, E. C. Bruen 901,319
Sound box, J. S. Kerr 901,713
Sound reproducer, W. A. Chapman 901,782
Spark arrester, A. Hall 901,807
Spindle driving mechanism, H. Allen 901,515
Spinning and twisting frames, appliance for cleaning the delivery rollers of mule, W. A. Cordingley 901,784
Spraying apparatus, liquid, H. L. Doherty 901,597
Spreading device, J. A. Birsfield 901,673
Spring wheel, J. E. Stannard 901,751
Stacker, straw, Clymans & Flautt 901,882, 901,884
Stamp mill tappet, M. P. Boss 901,417
Stamp, time, F. Purdy 901,469
Stanchion, cattle, Neumeister & Burhop 901,366
Stay for garments and the like, J. R. Dean 901,426
Steam engine, G. E. Riblet 901,472
Steering apparatus control mechanism, F. M. Leavitt 901,355
Stirrup, R. E. H. Johnson 901,908
Stock fountain, E. E. Norquist 901,730
Stocking supporter, T. Papworth 901,734
Stool, folding, G. S. Hutchinson 901,904
Stop and waste, reversible compression, W. G. Rowell 901,481
Store fixture, J. M. Walker 901,665
Storing and display case, G. A. McNamar 901,638
Stove lid lifter, A. Smith 901,844
Strainer, gutter, H. Dixon 901,526
Strip feeding mechanism, C. E. Brooks 901,517
Structure, reinforced, D. W. Norton 901,551
Stud, lacing, L. B. Davis 901,694
Supervisory system, M. S. Conner 901,683
Surgical table, S. M. Langworthy 901,628
Swings, benches, etc., anchor and base plate for lawn, A. W. H. Weber 901,761
Switch box, universal, W. M. Brown 901,776
Switch point retaining device, A. R. Murray 901,726
Switch stand, H. S. Goughnour 901,804
Switch structure, H. C. Stiff 901,752
Switch structure, H. S. Goughnour 901,803
Switchboard, M. S. Conner 901,688
Switchboard jack, multiple, J. A. Birsfield 901,672
Table, H. Kardos 901,914
Tablet forming machine, B. W. Scott 901,937
Talking machine, W. A. Chapman 901,781
Tanning ooze, G. A. Sweetman 901,564
Tape reel, P. Ferber 901,896, 901,897
Telegraphic sounder, V. C. de Ybarrondo 901,861
Telegraphone principle, apparatus for recording and reproducing by the, H. R. Stuart 901,397
Telegraphy, L. M. Potts 901,372
Telegraphy, space, O. C. Roos 901,649
Telephone call indicator, E. T. Ducharme 901,894
Telephone circuit, subscriber's, H. M. Post 901,738
Telephone exchange system, M. S. Conner, 901,684 to 901,686
Telephone exchange system, W. M. Davis 901,696
Telephone exchange system, automatic, B. G. Dunham 901,698
Telephone exchange system, multiparty line, G. Babcock 901,669
Telephone receiver holder, G. J. Thomas 901,880
Telephone system, E. R. Corwin 901,785
Telephone transmitter, M. S. Conner 901,687
Telephone transmitter protector, J. Baumgarten 901,869
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Tent, F. H. Goltsche 901,802
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Threshing machine feeder, pneumatic, C. W. Sellers 901,490
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Time register, watchman's, A. A. Newman 901,462
Timepieces, attachment for, F. Paquette 901,822
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Tire cover and fastening means therefor, I. J. D. Fairhurst 901,602
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Turbine, Rowan & Laux 901,385
Turbine, S. Z. de Ferranti 901,931
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Turbine bucket wheel, W. L. R. Emmet 901,430
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Typewriting and printing machine, combined, W. H. Collier 901,682
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Universal coupling, G. A. Anderson 901,864
Valve, ball cock, E. G. Watrous 901,571
Valve controlling means, J. W. Kenevel 901,712
Valve controlling mechanism for internal combustion engines, H. M. Neer 901,365
Valve, flushing, T. F. Payne 901,467
Valve, flushing, W. H. Bowman 901,584
Valve, piston, H. S. Sprague 901,846
Van, moving, A. B. Yetter 901,766
Vault doors, mounting for heavy, G. L. Damon 901,425
Vault ventilator, movable, Holmes & Damon 901,710
Vaults, mold for making burial, T. M. Cass 901,523
Vehicle brake, J. K. Kendrick 901,451
Vehicle controlling mechanism, power driven, C. W. Willette 901,508
Vehicle frame, C. J. Pembroke 901,735
Vehicle springs, brace for supplementary, W. Young 901,767
Vehicle springs, steadying device for supplementary, W. Young 901,578
Vehicle steering mechanism, self-propelled, C. B. Hatfield 901,898
Vehicles, differential gear for motor, C. J. Pittman 901,826
Vessels, means for transporting, E. L. Burwell 901,589
Washboards, soap holder for, Adams & Schaller 901,768
Washing apparatus, clothes, M. J. Baker 901,313
Washing machine, D. McMannama 901,817
Watches, roller for, J. Schoop 901,487
Water closet, G. M. Depew 901,525
Water closet, E. G. Watrous 901,572
Water closet apparatus, W. U. Griffiths 901,438
Water closet ball valve, T. F. Payne 901,466
Water closets, etc., automatically closing valve for flushing, W. H. Bowman 901,583
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Water purifier, H. Korten 901,352
Water trap, F. W. Meier 901,922
Watering device, stock, F. E. Williamson 901,860
Wave motor, T. H. Settle 901,489
Wedge cutter, L. W. Rouland 901,384
Weed puller, G. N. Nelson 901,820
Well plug, gas, W. F. Burgess 901,874
Welt beater, J. J. Heys 901,446
Wheel, H. M. Verplanck 901,568
Wheel, A. L. Jiminez 901,907
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Woodworking cutter, rotating, C. F. La Follette 901,626
Work holder, C. M. Deems 901,595
Wrench, C. R. Olberg 901,821
Wringer, S. C. Lawlor 901,919
Writing and similar instruments or tools, holder for, W. Kunde 901,452
Yoke center, neck, C. Lukasiewics 901,542

DESIGNS.

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Bottle, D. Taylor 39,625
Emblem, L. J. Fox 39,622
Grinding mill standard, C. N. McLaughlin 39,627
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Screen, closet, J. W. Kelly 39,631
Seat end, E. G. Budd 39,630

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Atomizers, air pump, W. K. Jahn 70,930
Beer, Du Bois Brewing Co 70,987
Beer, ale, and porter, lager, International Brewing Co 70,990
Belts, ladies', S. Isaac 70,957
Boots and shoes, leather, Locke Shoe Co 70,975
Calcimine, Isley Doubleday & Co 70,956
Calcimine, Muralo Co 70,997
Canned fruits and vegetables, apple butter, catsup, and mince-meat, Nave-McCord Mercantile Co 70,960
Canned smoked Norwegian sardines in olive oil, H. B. Ritchie 71,000
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Fertilizing materials, Wilson & Toomer Fertilizer Co 70,947, 70,948
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Fishing lines, E. J. Martin's Sons 70,994
Flour, wheat, Ogilvie Flour Mills Co 70,962
Foods, certain, Foley Bros. & Kelly 70,988
Gin, straight sloe, G. Stiegler & Co 71,003
Grapes, baskets and packages of, Keystone Grape Co 70,958
Gum, chewing, F. J. Banta & Son 70,981
Gum, chewing, Zei Manufacturing Co 71,005
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Hosiery, Shaw Stocking Co 71,001
Ink and indelible fixative, indelible, R. T. Swenning 70,945
Loom temples, Draper Co 70,986
Magazine, Cushman Co 70,953
Magazine, weekly, H. J. Bohn & Bro 70,934
Matches, J. A. Hunt 70,928, 70,929
Meat extracts, Compagnie des Produits Kemmerich Societe Anonyme 70,952
Oil, cotton seed, Union Oil Co 70,965
Oil, linseed, Mound City Paint and Color Co 70,996
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Oily preparation, certain, Jacques Wolf & Co 70,991
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Sardines, Neuman & Schwiers Co 70,961
Saws, coping, F. P. Maxson 70,995
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Soap, Fisk Manufacturing Co 70,937
Syrup, root beer, Stevens & Dow 71,002
Tea, herb, J. C. Frese & Co 70,938
Teeth, porcelain, Dentists' Supply Co 70,927
Textiles, certain, Adams Manufacturing Co 70,980
Tonic, iron, S. Albert 70,932
Undershirts, drawers, and pajamas, Tim & Co 70,977
Wall coatings, Muralo Co 70,959
Watches, watch cases and movements, American-Swiss Watch Co 70,931
Watchmakers' tools, Kendrick & Davis 70,993
Whisky, B. Ganim & Bro 70,982

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"Acme Bar Polish," for a polish, M. Bloomington 14,419
"Aroma," for cigars, McKenzie Bros 14,409
"Brilliantine Metal Polish," for metal polish, Smith Bros. Hardware Co 14,420
"Corker," for cigars, Hilson Co 14,410
"Gold Medal Bread," for bread, F. T. Short 14,415
"Griffing Chocolate Co. Breakfast Cocoa," for cocoa, Griffing Chocolate Co 14,413
"J. Pollack's Famous Stogies," for stogies, J. Pollack 14,411
"Kantleak Duck," for a waterproofed duck, H. Gitterman & Co 14,422
"Kerchiefs," for handkerchiefs, Royal Paper Box Manufacturing Co 14,423
"Kleanwell," for tooth brushes, Alfred H. Smith Co 14,416
"No-Dust," for a compound to be used for the purpose of allaying dust when sweeping floors, Webb-Freyschlag Merc. Co 14,421
"Oxford Linen Mills Pure Linen," for linen, Oxford Linen Mills 14,424
"Sulpho-Tri-Terpenes," for a veterinary remedy, C. E. Frazier & Co 14,418
"The Key to Your Success," for a skin cultivator and germ eradicator, G. A. Schmidt 14,417
"The Weber Cocktails," for a beverage commonly known as cocktails, C. F. Weber. 14,412
"Witch Brand Flour," for flour, Sands, Taylor & Wood Co 14,414

PRINTS.

"John J. Clark's Best 6 Cord Spool Cotton," for spool cotton, Blodgett & Orswell Co. 2,365

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., 361 Broadway, New York.

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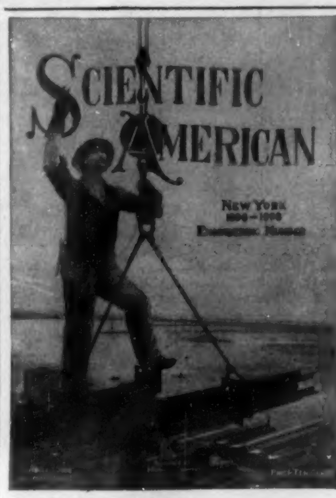

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